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A YEAR OF EXPORTS.

The figures of export trade are now complete for the whole year ending June 30, and we are thus able to compare them with those of the preceding year. They have remained to the end true to the characteristics that have been so strongly pronounced during the whole period; that is to say, there has been a steady and marked gain in the export of miscellaneous instruments and apparatus and a falling off in heavy electrical machinery. This differentiation was maintained in June, and there seems to have been no cure found for it yet. The export of smaller stuff during June was $902,593 as compared with $595,044 in June, 1909; while the export of heavy machinery was $586,202 as compared with $687,453. The gain in the one instance and the decline in the other is certainly sharply marked.

Taking the total figures for the year we find that the export of instruments and apparatus reached $8,694,132 against only $6,074,865 in 1909, a gain of $2,619,267. On the other hand, the total for heavy electrical machinery was $6,048,263 against $6,449,526, a loss of $401,263. It follows that the net gain for the year on the whole electrical export trade was $2,211,004, which is comforting and encouraging to say the least. The total for 1910 was $14,742,395, as compared with $12,524,391 in 1909. But 1910 was still somewhat behind 1908 when a total was reached of $15,159,436. That year the importance of the two items was almost exactly reversed from 1910, and heavy machinery then amounted to $8,405,219.

The trade of the year shows British North America to have continued an excellent customer and our best, but Brazil and Mexico come to us with a large demand, while the Japanese trade has shrunk. The United Kingdom seems to be buying again, but is far behind its old figures; and France and Germany are not the customers they were formerly. Evidently we need to vary our exported product, seek the general markets not supplied by their own manufacturers, and take new hope from the new data.

FINANCING PUBLIC UTILITIES.

The decision of the Public Service Commission of the First District of New York rejecting the petition of the bondholders' committee of the Third Avenue Railroad Company is one of the most important handed down by that body since its formation. It presages the attitude of the commission toward reorganization schemes which involve the issuance of securities for the acquisition of property to be conveyed to a new company; and indicates that even though the securities are issued at par for old securities, unless the actual present value is equal to par, "not approved" will be written across the face of the application. Reiterating the policy of probably every other public service commission in existence, it makes physical valuation plus certain intangible values the basis of bond issues; and in order to arrive at just valuations, exhaustive investigations of the property are made. The handwriting on the wall

is plain; public utilities must be managed in the interests of security holders and patrons and not for the enrichment of speculators.

Many persons fail to distinguish between a private corporation and a public-utility company because both are susceptible of capitalization and both dispose of their bonds to the same public. By good management both may be made paying investments, and yet what is permitted to one is denied to the other. The former may net its stockholders 100 per cent or more per annum; but no such dividends can be given to the stockholders of the latter. Little by little the government has assumed to regulate public utilities in the interests of the people, and while not withholding a fair return to investors, it expressly stipulates that the public must not be fleeced. The opponents of such regulation by the State urge that under such throttling influence it is difficult, if not impossible, to interest capital in new undertakings. The records of the commissions, however, tend to disprove this contention, and so long as the public service commission laws remain on the statute books and are honestly and intelligently administered, investments in the bonds of public-utility companies should be every whit as safe as investments in first mortgages on real estate.

ELECTRIC TRANSMISSION AND IRRIGATION.

Much of interest centers around the interrelation between electric transmission and irrigation undertakings by reason of the valuable assistance given by the one to the other. Probably in no two irrigated districts are the conditions identical, so that comments that apply in one locality may have almost no bearing in other places. Certain hydroelectric undertakings that would have been considered commercially impossible when not combined with irrigation prove highly advantageous when irrigation is the prime object sought. On the other hand, there are localities where profitable irrigation would be an impossibility without the existence of electric transmission equipments installed primarily for other purposes. Our columns in this issue contain notes on electric transmission installations and irrigation equipments falling in both of the above classes.

He would indeed be considered bold who would attempt to convey water 200 miles for the purpose of obtaining a fall of several hundred feet for developing, say, 100,000 hp, yet such a scheme is being applied in California with full confidence of meeting with financial success, because the water will be utilized for irrigation after its total travel of 250 miles. In Colorado transmitted electrical energy is employed for operating pumps to raise to the surface certain underflow water that would otherwise be useless for irrigation, and to elevate gravity surface-flow water to points well above the irrigation ditches, thus adding immensely to the value of land previously beyond the irrigated range. Strangely enough, in the Colorado case noted in this issue the energy is not obtained from a hydroelectric installation, but from a generating plant located immediately at a coal mine. The last-mentioned combination is probably thoroughly unique, while the former is typical of a large number of equipments, one of which, in Utah, was mentioned in our issue for last week.

Our issues for July 15 and Oct. 28, 1909, contained descriptions of additional electrical transmission systems in Utah and California, where the energy is obtained from water intended for irrigation and is utilized in part for elevating the water for irrigating land above the ditches and for pumping water from the underflow. In our issue for May 19, 1910, was described an electric transmission system used largely for supplying energy for driving irrigation pumps in California, while on June 9, 1910, there was given a description of an installation in Kansas used exclusively for this purpose.

In whatever combination they may be found, irrigation and electrical transmission are mutually beneficial. Where the water is intended primarily for irrigation, certain restrictions are placed on the use of the water for developing hydroelectric energy such as the maintenance of constant flow, but the load afforded by pumps for elevating the water above the ditches is constant throughout the irrigating period and compensates largely for the restrictions. It is difficult to conceive of a more advantageous load for a transmission system than that of motors used in irrigation; not only is the daily load-factor almost 100 per cent, but the yearly variation in the pumping load tends to counterbalance the yearly fluctuations in the lighting load. Although perfect results demand a constant flow of water in the irrigation ditches, and this condition provides an excellent character of load for the transmission system, yet a slight interruption to the continuity of service is of no very great importance, and, when desirable, the pump motors can be left idle for several hours at night without detrimental effects upon the crops. For the above reasons, in installing a transmission equipment for supplying energy to irrigation motors many of the expensive refinements commonly introduced solely for the purpose of avoiding momentary interruptions in other services need not be employed. It is safe to state that wherever irrigation can be carried out the electrical transmission company in that neighborhood is neglecting an opportunity for obtaining a highly desirable load unless it is co-operating with the farmers in developing the agricultural resources.

ITALIAN THREE-PHASE LOCOMOTIVES.

In the current issue we give for the benefit of those interested in main-line electrification the facts about the three-phase electric locomotives of the Giovi line in Italy. As is well known, the three-phase system has proved successful on the Valtellina railway for the last seven years and the Government has been so encouraged at the results that there is at present an appropriation of 300,000,000 francs for extension of the system of the Government lines. The interesting features about the locomotives here described is that they are intended chiefly for freight service, freight being the main traffic in some of the lines under electrification. Trial runs have already been made with the locomotives. The construction is especially interesting in that all the drivers, five pairs, are united by connecting rods; the induction motors furnish the torque through connecting rods applied to the two central drivers, which are without flanges. The motors are designed for 3000 volts working pressure at 15 cycles; they are arranged for cascade connection, giving 112½ r.p.m. and 225 r.p.m., intermediate speeds when necessary being obtained by inserting resistance in the secondary. The drive is a beautifully flexible one, all shocks being taken up by springs so that the motor is practically independent of any changes of position while in practice. Particularly to be mentioned is the simple trolley arrangement in use. It is a single bow carrying a steel shaft in ball bearings with two hard-bronze

sleeves insulated from each other and serving to take current separately from the two trolley wires. One interesting feature to ensure safety of working is that the high voltage wiring is so run and interlocked that no access can be had to it save when the trolley bow is pulled down clear of the trolley wire. Control is by air-operated switches.

The Giovi locomotives are particularly designed for work on grades up to 3.5 per cent, handling heavy freight trains, and tests have shown that the power developed rises to 33.2 hp per ton. This is a figure more than double that given by the steam freight locomotives ordinarily in use and also fully double that of the Swiss and German single-phase locomotives. The ability of the three-phase type of motors to carry large overloads is, of course, very well known, but the excess here indicated is an exceedingly important matter when it becomes necessary to haul a heavy freight train over the steep grade. The cost of a locomotive is claimed to be rather more favorable than that of one of the single-phase type, so that in the matter of haulage capacity it presents unusual advantages. The possibility of restoring energy to the circuit by motor braking down grade is one which has always been an attractive feature of the three-phase system, although, in fact, it is rather seldom that any very advantageous use can be made of it. On some of the Italian lines there seems to be a better chance than usual to utilize regenerative control, and it is found by experiment that about 55 per cent of the up-grade energy can be restored on the down grade and in some cases even better results can be obtained. It is generally believed among engineers that the three-phase system is one of special rather than general application, but the recent Italian results are of a character to make one stop and think seriously whether it is wise to turn the system down on reasons which thus far have been chiefly theoretical. Comparisons of this locomotive with the single-phase locomotives of the New York, New Haven & Hartford Railroad would be somewhat odious, because, as is well known, the latter machines have never had a fair chance, being terribly handicapped by the modification and complications necessary to enable them to receive energy from both an overhead catenary alternating-current circuit and an under-running, third-rail, direct-current circuit.

ELECTRIC WAVE RADIATION FROM INCLINED ANTENNAS.

The original type of wireless-telegraph antenna was a vertical mast, supporting a single vertical wire. Attempts were then made to extend this vertical conductor, both in height and in cylindrical area. The increased height was obtained by raising the mast elevation. The increased cylindrical area was obtained by multiplying conductors and spreading them. Finally, a limit was found for the height of the conductor by reason of the expense of construction. A few high elevations are afforded by tall structures, such as the Eiffel Tower in Paris, or the Singer Building in New York, but, except in such favored locations, the cost rises much faster than the altitude. This is true both on ship and on shore. On ships high masts were originally installed for raising and supporting large sail areas. With the advent of steam propulsion, mast heights descended to the levels of mere cargo hoists. Recently, however, cases have occurred in which steamship masts have been raised, solely to support higher wireless telegraph antennas.

When the greatest elevation expedient for a particular station had been reached, and it was desired to extend the power of the station as far as possible within the limitation of that elevation, the most convenient and economical plan arrived at was to employ a pair of supporting masts, and to carry the antenna horizontally between their tops, after reaching the top level. This plan is particularly adapted for use on board ship. The question then rose as to the nature and relative intensity of the radiation emitted from such an inverted L antenna. The theory of the subject has not yet been simplified, but it has been shown by Fleming that the radiation emitted is more powerful fore and aft, or in the direction of the horizontal element, than athwart, or in quadrature thereto. That is, the velocity of an outgoing wave is the same in all directions from the antenna, but the intensity of the wave is greatest along the axis of the horizontal element, and least across the axis.

A communication has recently been presented by Prof. A. Garbasso to the Accademia dei Lincei at Rome on the radiation from a straight antenna inclined at an angle, like the leaning tower of Pisa. The theory of this case is simpler than that of the inverted L antenna. The communication shows that such an antenna oscillates harmonically in a manner resembling that of an upright antenna of the same maximum height, except that whereas the radiation from an upright antenna is manifestly symmetrical and uniform in all directions, that of the inclined antenna is dissymmetrical, being strongest along the line of vertical projection, and weakest at right angles thereto. That is, if we suppose the sun to be shining immediately overhead, the radiation will have maximum intensity in the direction of the shadow of the inclined antenna on the ground, and will have minimum intensity across this direction. The graph of this intensity in the horizontal plane is an ellipse, with its center at the base of the antenna, and its major axis along the shadow line. In the case of an antenna inclined 45 deg. with the vertical, the result shown is an energy intensity twice as great in the major axis as in the minor axis, which means that the voltage intensity in the least favored direction is 70.7 per cent of that in the most favored direction. This solution of the problem accords with that already published for the inverted L antenna, because the latter may be regarded as a first approximation substitute for an inclined straight antenna. According to theory, therefore, the signals emitted by a steamship from an inverted L antenna between the masts should be stronger in the direction of the vessel, or fore and aft, than abeam, provided that the screening effects of the steel masts and smokestacks can be disregarded. Quantitative evidence is still lacking on this question. To answer it requires that such a steamship should send signals continuously of uniform strength while steaming slowly in a circle, the intensity of these signals being measured continuously by an observer at a distant receiving station. In regard to the receiving powers of inclined and bent antennas, it seems clear that the e.m.f. of the received signals is limited by the height of the receiving antenna, but that both the quantity of electricity and the amount of electric power capable of being delivered to the receiving instrument partly depend upon the horizontal element of the antenna, being greatest for the direction of incoming waves along the axis of that element, and least along the perpendicular thereto. The best available conditions of tuning are, of course, here assumed.

Hydroelectric Energy from the Los Angeles Aqueduct.

Progress in the construction of the 250-mile aqueduct being constructed by the city of Los Angeles from Owens River across the Mojave Desert, beneath the Coast Range and into Los Angeles, has been so satisfactory that the engineers report that two-thirds of the work has been completed and one-half of the distance has been covered. The cross-section of the aqueduct is sufficient to convey 300,000 cu. ft. daily to two storage reservoirs at its lower end. At three points along its route hydroelectric generating plants will be erected to utilize the energy of the falls, the highest of which is 800 ft. It is estimated that a maximum of 120,000 hp is available, two-thirds of which amount can be developed within 50 miles of Los Angeles. Arrangements have already been made for developing 49,000 hp at the time of opening the aqueduct in May, 1912. It is expected that much of the hydroelectric energy will be utilized in connection with the enterprises brought into existence with the irrigation of desert land made possible by the construction of the aqueduct.

The chief engineer for the Los Angeles aqueduct is Mr. William Mulholland. The electrical engineer is Mr. E. F. Scattergood.

Electric Pumps for Raising Underflow for Irrigation.

Mr. C. H. Williams, general manager of the Northern Colorado Power Company, has called the attention of the people of Colorado to the advantages to be derived from utilizing "underflow" water for irrigation. He claims that the entire territory covered by the system of the Northern Colorado Power Company is underlaid with strata impervious to water, above which lies a loose deposit through which the water finds its way with small resistance. The water lies from 20 ft. to 25 ft. below the surface in dependable quantities, and is being elevated to the surface for irrigation by electrically-driven pumps at a large number of points. The water taken from each well is sufficient to irrigate tracts of from 20 to 120 acres.

With 2300-volt induction motors and well-designed centrifugal pumps the cost of pumping is $2.52 per acre-foot, which depth is sufficient for irrigation through an average season.

One of the districts in which the pumping work is developing most rapidly is that northwest of Greeley. A little over a year ago a substation was built at New Windsor where 60 kw of transformers were installed to change the 44,000-volt high-tension e.m.f coming from the Lafayette power house to the 2300-volt energy used for local distribution in the town and for the work of pumping. Before the town was thoroughly covered by electric wires it was found necessary to increase the transformer equipment to 100 kw and six months later this was again increased to 225 kw.

After the irrigation season closed the farmers found use for their motors for cutting and grinding alfalfa and other farm products for feeding stock. Several new industries located in Windsor, attracted by the cheap energy, and the demands of these, together with those of a very rapidly growing, healthy community, required the installation of transformers as now in use, and the rapidity with which the popularity of the electric pumping is growing has made it evident that the equipment of this substation will soon have to be doubled and 150 kw of transformers installed.

Proposed British Association of Consulting Engineers.

A meeting, presided over by Sir William Preece, K.C.B., F.R.S., past-president of the Institutions of Electrical Engineers and Civil Engineers, was recently held to consider the desirability of forming an association of consulting engineers. The object of the proposed association is to form a recognized group of bona fide independent consultants who would constitute a body for the protection of their interests and the interests of the public generally, and to improve their status and professional position, following the examples of the council of the bar, of the medical council and of the chartered accountants.

Invitations had been issued to a number of consulting engineers at the instance of a provisional committee, and most of the prominent consulting engineers were represented or sent letters expressing regret at their inability to attend and their sympathy with the movement. Mr. Midgley Taylor, who presided in the absence of Sir William Preece at the beginning of the meeting, said that the subject had been before a number of consulting engineers for the past two years or more, and as some initial step had to be taken, the members who originally took the subject up formed themselves into a provisional committee with the result that the meeting was called to pass on the action taken by the committee in the past. The object of the meeting was to see whether the general idea of the formation of the association met with the approval of the consulting engineers in that country. It was considered necessary, in the interests of the public as well as in their own, that the genuine consulting engineer should be distinguishable from those who were not genuine consulting engineers, but had trade interests. He felt that the public also wanted protecting. At the present time, if a municipal authority erected works, even of large magnitude, they were not compelled to employ a qualified man to advise them, and there was nothing to prevent an absolutely unqualified man going to the particular authority, offering his services and being retained. It was an anomaly for this to be possible in matters where public safety and the expenditure of large sums of public money were involved. In matters of health or law, or finance, the safeguard was that the doctor or solicitor or accountant who was consulted was a member of a recognized body, and it was felt that the public should have the same protection in engineering matters.

Under those circumstances he felt they should endeavor to form an association such as would not only protect the bona fide consulting engineer, but would also protect the various public bodies and persons who were anxious to get a properly qualified man to advise them on engineering works. The committee hoped that the meeting would result in the formation of the association, but at the same time they wanted to have an open expression of opinion from everyone whether they were favorable or otherwise.

Mr. Swinburne was then called upon to propose the formation of the association, and formally proposed that the association should be formed and asked the meeting to look at the matter as broadly as possible and for all to work together for the one end. After some discussion, Sir William Preece, as chairman, said that he was in entire sympathy with the movement, and remarked that what was wanted was a very strong committee with a strong chairman to carry the matter to a successful conclusion. He put the resolution to the meeting that the association be formed, and this was carried unanimously. It was then suggested that the following gentlemen should be asked to form a committee: Messrs. Robert Hammond, C. Hunt, B. M. Jenkin, Baldwin Latham, S. R. Lowcock, E. L. Mansergh, W. M. Mordey, W. H. Patchell, Sir William Preece, Henry Rofe, J. F. C. Snell, E. H. Stevenson, James Swinburne, Midgley Taylor and Henry Woodall. This committee was unanimously elected, and Mr. A. H. Dykes, of 1 Victoria Street, Westminster, S. W., was elected as honorary secretary.

Electric Vehicle Progress.

It is claimed that a single electric vehicle manufacturing company is receiving orders at the rate of between 50 and 60 electric trucks per month, the most popular sizes being of from 2 tons to 5 tons rating. On the basis of the increasing use of electric vehicles it is said that the sale of energy for charging vehicle batteries by central stations is on the threshold of a remarkable expansion. It is expected that the charging income of the Rochester Railway & Light Company will be practically doubled in the present year. Mr. E. S. Mansfield, of the Edison Electric Illuminating Company, Boston, stated recently in the Boston *News Bureau* that in Massachusetts alone

the number of registered vehicles electrically propelled increased from 412 on April 1 to 571 July 1. In the Boston Edison territory there are now 55 business and 176 pleasure vehicles with electric motive power, and the sales of energy for charging service bid fair to become an important part of the company's business. A marked increase in interest in this form of transportation is evidenced in central-station circles serving territory with reasonably good roads and fairly level topography. On account of early unfortunate experiences with electric trucks some years ago, before the present grade of apparatus was on the market, Boston has been slower to take up this form of transportation than have many of the smaller cities of the country. Recognizing the possibilities of operation on the superb roads of the Boston metropolitan district, the Boston Edison company has taken up the campaign in vigorous co-operation with the manufacturers, and it is planned to interest men of affairs in the subject in the fall through aggressive meetings of the Electric Vehicle and Central-Station Association. It is probable that the Boston Chamber of Commerce will be asked to co-operate in some campaign of education on behalf of the motor truck as compared with horse-drawn vehicles.

The Japanese Electrical Industry.

BY M. KAWARA.

A collection of electrical statistics compiled by the Japanese Government, and published in the *Electrician's Friend,* of Tokyo, contains some interesting figures and shows the general trend of the industry in Japan more clearly than anything yet published. The following tables refer to the year 1908:

Generators listed under the head "ordered" were mostly in plants in course of construction. It is to be noted that the new plants are adopting larger generators, and that the size of stations is growing more than their number, as the use of higher voltages becomes more and more common. For instance,

TABLE I.—JAPANESE ELECTRICAL GENERATING STATISTICS FOR 1908.

Source of Power	Generators		Kw. Rating	
	Operating	Ordered	Operating	Ordered
Water	274	81	61,376	65,237
Steam	857	105	94,202	27,329
Gas and oil	69	10	757	219
Electricity	18	3	243	300
Total	1218	199	156,578	93,085

the average rating of hydraulically driven generators in operation is 220 kw, while the rating of those under construction is 804 kw. The average ratings for steam-driven generators are 170 kw and 260 kw respectively.

Classified according to the voltage adopted the following figures obtain:

TABLE II.—VOLTAGE ADOPTED IN TRANSMISSION SYSTEM.

Limiting Voltage	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No.	Rating
500	800	64	30,596	7,258	864	37,854
3,000	386	115	93,502	70,127	501	163,629
——	32	20	32,480	15,700	52	48,180
Total...	1,218	199	156,578	93,085	1,417	249,663

Table II also confirms what has been said regarding the size and voltage of generating stations.

Classified with reference to direct and alternating current the results are as given in Table III.

Here again it will be noted that the majority of the stations under construction adopted alternating current, which means higher voltage and longer transmission lines.

TABLE III.—TYPE OF GENERATORS.

Kind of Machine	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No.	Rating
Direct current.....	791	64	29,645	10,258	855	39,903
Alternating current	427	135	126,933	82,827	562	209,760

The following table shows the sizes of generators, including both those already in operation and those in process of erection:

TABLE IV.—GENERATORS ARRANGED ACCORDING TO RATING.

Limiting Size	Generators		Kw Rating		Total	
Kw	Operating	Ordered	Operating	Ordered	No.	Rating
10	186	9	1,017	55	195	1,072
50	481	27	11,900	806	508	12,706
100	195	18	12,521	1,145	213	13,666
500	274	80	52,595	16,989	354	69,584
1,000	46	35	27,445	23,705	81	51,150
——	36	30	51,100	50,385	66	101,485
Total...	1,218	199	156,578	93,085	1,417	249,663

The frequency of the alternating-current generators varies from 50 cycles to 133 cycles. The predominating frequency

TABLE V.—GENERATOR ARRANGED ACCORDING TO FREQUENCY.

Cycles	Generators		Kw Rating		Total	
	Operating	Ordered	Operating	Ordered	No.	Rating
50	71	28	44,811	27,690	99	72,501
60	275	85	64,485	49,547	360	114,032
100	15	1	2,041	30	16	2,071
125	27	2	2,191	120	29	2,311
133	9	—	600	.....	9	600
Others	30	19	12,805	5,440	49	18,245
Total...	427	135	126,933	82,827	562	209,760

is 60, due largely, perhaps, to the fact that the majority of the generators are of American manufacture, as shown in Table VI.

TABLE VI.—GEOGRAPHIC DISTRIBUTION OF MANUFACTURERS.

Manufacturer	Generators	Kw Rating
United States	434	87,369
General Electric Co	277	68,455
Westinghouse Co	89	13,736
Stanley	7	640
Warren	7	345
Others	54	4,193
Germany	107	36,435
Siemens & Schuckert Co	85	32,970
Allgemeine Elektricitäts-Gesellschaft	21	3,450
Others	1	15
England	45	7,211
Bruce & Peebles	5	2,475
Mather & Platt	15	525
Others	25	4,211
Switzerland	5	955
Brown Boveri	3	895
Others	2	60
Belgium	..	.....
International Electric Co	6	281
Japan	171	15,605
Shibaura works	122	12,524
Miyoshi works	19	692
Ishikawa Shima shipyard	9	1,086
Osaka Electric Light Co	8	373
Meidensha	5	312
Mitsubishi shipyard	3	520
Others	5	99

The high-frequency machines are old and without doubt will soon be replaced by standard low-frequency generators. In recent projects 25 cycles has been proposed, and it is likely that this frequency will be adopted.

Of 787 generators rated above 50 kw, and now in operation, 171 machines, with a total rating of 15,605 kw, are of domestic make; 577 machines, with an aggregate rating of 132,251 kw, are imported, and the remaining 20, with a combined rating of 695 kw, are not clear as to their origin. The manufacturers who supply these generators are given in Table VI.

Although there are a number of home manufacturers, a great majority of generators are of foreign make, especially the larger units. The development of electrical industry is so fast that the home manufacturers cannot keep pace with it. Table VII brings out this point more clearly.

TABLE VII.—IMPORTS OF ELECTRICAL GOODS.

Material	1906	1907	1908
Insulated Wires	$103,821	$1,231,356	$933,565
Electrical machinery	952,043	1,271,469	1,860,588
Lamps, Sockets, etc.	118,197	63,395	611,338
Telephones	57,372	52,763	56,531
Electric Traction Machinery	152,876	279,266	231,018
Steam Turbines	64,906	502,984	375,207
Engines	441,699	675,084	883,333
Boilers	619,181	732,115	665,859
Gas and Oil Engines	109,046	274,739	283,313
Total	$2,619,141	$5,083,171	$5,900,752

The electrical machinery which appears in the second row in the above table was supplied from the following countries, as shown in Table VIII:

TABLE VIII.—VALUE OF ELECTRICAL IMPORTS.

Countries	1906	1907	1908
United States	$564,656	$763,437	$1,169,762
England	221,267	353,757	333,518
Germany	99,125	146,741	338,337
Other countries	66,995	7,534	18,971
Total	$952,043	$1,271,469	$1,860,588

From the two last tables it is seen that the home manufacturers are unable to keep pace with the fast growing demand, and consequently the importation of electrical goods is increasing at about an average rate of 50 per cent per year even during times of financial distress, which have been felt over Japan as keenly as in the United States. Among the exporters to Japan, the United States obtains the bulk of the trade, about 60 per cent of the total. Germany seems to be improving rapidly, while England holds its own.

New Generating Equipment for Springfield, Mass.

The United Electric Light Company, of Springfield, Mass., has decided to install an additional Westinghouse-Parsons turbo-alternator in its main steam plant on the Connecticut River at the foot of State Street. The turbine will be of the double-flow type and the generator will deliver energy to the switchboard at 5500 volts. It will be installed in the addition to the station which was completed about two years ago, on the south side of the previous plant. Six 400-hp boilers, with Murphy furnaces and separate stacks, will be installed in connection with the turbine service. The plant already has a 2500-kw unit in service, and in the old station are three 1000-kw turbines. The switchboard will be remodeled to facilitate operation in connection with the company's plants located outside the city, which are run by water-power. For a number of months the scarcity of water has been a decided drawback in the operation of the hydroelectric generating units of the company.

The concentration of power generation in the State Street station will enable the company to handle its local street lighting and motor service to the best advantage, and to cut down various transmission losses which have formerly been encountered in connection with the city service. The arc machines were formerly located mainly at the Indian Orchard plant, about 6 miles east of the city, and operated from a switchboard located in Springfield. At times of low water this arrangement involved the supply of energy from Springfield to Indian Orchard for driving motor-generators on the arc service, with double transmission losses. The removal of the arc machines to Springfield has resulted in a much more economical service and the operating flexibility is much improved. The new plant is operated as a part of the original station, although the two are mechanically independent, with separate boiler and turbine rooms. A common coal supply with electric crane service is utilized by the two portions of the plant.

Michigan Electric Association Convention.

The Michigan Electric Association will hold its annual convention at Hotel Harrington, Port Huron, Mich., beginning on the evening of Aug. 16 and lasting until the afternoon of Aug. 18. On Aug. 16 during the evening the president will deliver his annual address, and a general reception will be held.

On Aug. 17 and 18 the following papers will be presented: *Boiler-Room Practice,* by Messrs. Rosenkrans, Durand, Chase and Hart; *Accounting for Central Stations in Small Towns,* by Mr. F. B. Spencer, Sheboygan; *Real Cost of Street Lighting,* by Mr. F. R. Mistersky, Detroit; *Baking Enamel by Electricity,* by Mr. John Cavanaugh, Benton Harbor; *Power Factor of Welding Machines,* by Mr. A. S. Hatch, Cincinnati; *Flat Rates* for Residence Lighting, by Mr. R. S. Stewart, Detroit; *Cost of High-Efficiency Lighting,* by Mr. G. E. Westover, Cadillac; *Maintenance of Meters in Small Towns,* by Mr. R. M. Hemphill, Ann Arbor; *Tungsten Lamps,* by Messrs. Thomas Hinks, Mt. Clemens; C. W. Smith, Lapeer; H. A. Fee, Adrian; Eber Arnold, Marine City.

Among the entertainment features will be a boat ride to the Diamond Crystal Salt Works and a dinner at Stag Island on Wednesday afternoon and evening. During the afternoon of Thursday, Aug. 18, there will be a baseball game between the "Detroit Edisons" and the "Port Huron Independents," and a trip by way of the St. Clair tunnel and the ferry. The secretary of the association is Mr. A. P. Biggs, of the Detroit Edison Company.

Annual Meeting of the Maine Electric Association.

The annual meeting and outing of the Maine Electric Association was held at the Hotel Falmouth, Portland, on July 28 and 29, and a combined program of business and pleasure was enjoyed by a large number of representative central station men in attendance. The social features of the occasion included a steamship trip down Casco Bay to South Harpswell and a clambake at the Merriconeag House, with a baseball game, races and other out-of-door sports. The following officers were elected for the ensuing year: President, J. A. Fleet, Portland; vice-presidents, C. J. Abbey, Skowhegan, and F. D. Gordon, Lewiston; secretary and treasurer, W. S. Wyman, Waterville. The principal feature of the technical session was a paper on "High-Tension Line Construction," by F. H. Mason, engineer of the Central Maine Power Company, Waterville.

HIGH-TENSION LINE CONSTRUCTION.

Mr. Mason emphasized the importance of continuous service in all high-tension line work, and pointed out the advantages of the private right of way, particularly in connection with railroad locations, where material can be most advantageously delivered. A contrast was drawn between line construction 10 years ago and that of to-day, the present tendency being away from glass insulators and wooden pins, and for moderately high potential service employing a galvanized iron pin with a porcelain base and wooden top. Metal pins cemented to the insulator have found favor in locations near the ocean. A 60,000-volt porcelain insulator is about 15 in. high and weighs about 30 lb., which makes it rather bulky for supporting on wooden poles. The added reliability of service in the face of a somewhat larger first cost of steel tower construction was touched upon. The wood pole is well adapted to a single three

phase line which is placed on it in the form of a triangle with apex at the top, where the insulator is supported by a ridge iron. At e.m.fs. above 33,000 volts the spacing for a double line becomes so great that the length of arms where two three-phase systems are arranged in triangles becomes unwieldly. Mr. Mason stated that no pole of less than 7-in. top should be used in high-tension work, a minimum of 8 in. being used at crossings and corner poles. He described standards of line construction in favor with his company, giving various details of pole setting, guying, etc., found advisable in recent line work in Maine and elsewhere.

The most recent practice in steel tower construction was reviewed by the author, who then passed to a discussion of the advantages of the suspension type of insulator in very high-tension work. Illustrations were given of insulators used on various transmission systems, and the benefits of the suspension type on long spans were emphasized. An 800-ft. span is used in carrying the Maine Electric Power Company's line across the Kennebec River at Augusta, and among other recent spans of this type is one of 1200 ft. across the Hudson River at Mechanicsville, N. Y. The Bar Harbor & Union River Power Company has an 800-ft. crossing near Bar Harbor, where two insulators are used at each end of the cable. Regarding sag, Mr. Mason stated that less could be allowed with copper wires than most text-books give without difficulty, but more slack must be allowed with aluminum. He referred to Mr. F. O. Blackwell's papers on "Transmission Line Construction" before the A. I. E. E. in recent years, and also spoke appreciatively of the chart given by Prof. Harold Pender in the *Electrical World* during 1907. Where there are many long spans the best method is to limit a given size cable to a certain strain under a certain temperature. Regarding transpositions, Mr. Mason said that for telephone work on transmission line poles, these should come about every five poles and on a special insulator. An insulated stand for the operator should be provided. In conclusion the author reviewed recent practice in lightning-arrester construction and high-tension crossing protection. In the Central Maine system 44,000-volt insulators are used on crossings instead of insulators designed for the line potential of 33,000 volts. The pins and cross-arm tops are all grounded, and nothing smaller than a No. 0 wire is used. The transmission line deserves a certain amount of protection by the public because it builds up the industries by which the public may live and helps the best conservation by enabling a vast amount of power to be used from sources that would otherwise be left idle. A demonstration of the methods of inside wiring was also given at the technical meeting.

Midsummer Convention of Automobile Engineers.

The midsummer convention of the Society of Automobile Engineers, held at Detroit, July 28 to 30, was chiefly given over to the discussion of structural problems among the gasoline-car designers. Representatives of half-a-dozen of the principal electric vehicles and manufacturers were among the 150 engineers present, but, with the exception of one paper, the work of the convention did not touch upon subjects of battery cars, nor the ignition, or lighting of the other types of automobiles. Mr. T. V. Buckwalter presented a paper describing the experience of the Pennsylvania Railroad with its electric baggage and delivery trucks at Philadelphia, Washington and Baltimore. Prof. W. H. Bristol delivered a classical review of high-temperature-measuring appliances, leading to the development of the modern pyrometer, which is an important aid in the heat-treatment of steels used in automobile construction. Professor Bristol also described a new type of automatic compensator for correcting for the temperature of the cold-couple in a pyrometer outfit. Mr. E. J. Stoddard presented a paper urging the establishment of a court of patent appeals made up of technically qualified judges.

At one of the sessions of the convention much discussion, generally favorable, was accorded the proposal to arrange all cars to be driven from the left-hand seat, departing from the generally established gasoline-machine practice and following a construction that has been embodied in all electric vehicles for a number of years. This arrangement, as the electric automobile men perceived some time ago, permits the driver to watch out for overtaking and passing cars with the least effort, and when applied to the gasoline machines with their bulky steering and controlling devices, will enable the driver and his companion on the front seat to draw up on the right-hand side of the street and alight directly onto the curb.

Gossip about the convention rooms indicated that next year will be an electric lighted one in the annals of the gasoline car, as most of the better-grade automobile manufacturers will equip their 1911 models with electric side and tail lamps, energized from a 6-volt portable storage battery. Oil lamps will be furnished for emergency use. The improvements in low-voltage tungsten lamps and storage cells and the general equipment of vehicles with electric lighting by their owners have led the manufacturers to add this additional feature. Automatic systems employing a generator driven from the engine shaft to keep the battery charged and supply energy to the lamps while running are also successfully used. Where only a tail lamp is to be operated in conjunction with the two gas headlamps, a set of primary cells may be employed to do the work probably as cheaply as the storage battery, and without the bother of recharging.

The Establishment of a Court of Patent Appeals.

An effort to define the social and legal relations of the engineer and the inventor in their increasing importance to the world at large is contained in a paper entitled "The Establishment of a Court of Patent Appeals," by Mr. E. J. Stoddard, which was read before the midsummer convention of the Society of Automobile Engineers at Detroit, July 28 to 30. The following paragraphs are excerpted from this discussion of the need for improved patent laws in the United States:

"It is proposed to create a court of practically final resort to hear appeals in patent cases, to take the place of the 9 or 10 Courts of Appeal now existing, with their conflicting decisions and numerous disadvantages. The necessity of such a court is obvious and pressing. The bill creating it has been favorably reported on by the House committee on patents and by the Senate committee on patents. It has been referred to the judiciary committee of the House, and is now before that committee. The bill provides for the appointment of a chief justice by the President of the United States, in the usual way, and that the Chief Justice of the Supreme Court of the United States shall designate four Federal judges to sit as associate justices for a term of six years.

"There are certain technical difficulties that the establishment of this court will surely cure. There are many complaints of the present administration of our patent laws. Such complaints are in a large measure just, and the faults remediable. But in remedying existing faults one does not want to introduce greater faults or destroy a right that should be the most sacred and firmly based of all rights to property. The change must be gradual. In establishing this court the service of the whole people must be kept in view, not that of any class or profession. It should not be a court in the interest of manufacturers, of engineers, or of lawyers, but a court that shall administer justice intelligently and carry out the will of the people as a whole.

"Our Federal judges are able and honorable men. Many of them are, perhaps, by education, taste and character, not adapted to cope with the mixed questions of law and engineering that arise in patent cases. On the other hand, it is believed that judges can be selected, as provided in the bill, who will be able to understand and decide justly a case that is properly presented to them, understanding and actualizing the spirit of the times."

It is said that a problem, properly stated, is half solved.

When this court has been established, there will be something definite upon which to concentrate influence and to hold responsible. The problem will at least have been stated.

Outing of Chicago Electric Club.

On board a special train and accompanied by a brass band of 12 pieces, 200 members of the Electric Club of Chicago journeyed to Ravinia Park in the beautiful North Shore suburban region, Saturday, Aug. 6, and after enjoying games, contests and a picnic luncheon, closed an ideal day's outing with a splendid Damrosch orchestra concert. The first event upon arriving at the park was a baseball game between the Married Men's and the Unmarried Men's teams, in which the former won by a score of 4 to 2, after playing three or four innings. No record was kept of the errors.

After a basket lunch, served on tables under the trees, the following athletic events were hotly contested: 100-yd. dash, for men; 50-yd. dash, for ladies; three-legged race, for men; potato race, for ladies; ball-throwing contest, for ladies; fat-men's race, and hobble-skirt race for ladies. In addition to these there were guessing contests as to the attendance at the outing, number of beans in a bottle, and identity of authors from puns on their names. A number of valuable prizes, almost 50 in all, had been contributed through the generosity of electrical business firms in Chicago, and these prizes were divided up among the more successful contestants in each of the events. Ten of these prizes were tendered to the winning baseball team and the elected umpire, Mr. J. G. Pomeroy, who drew lots to determine the order in which the more valuable ones were to be appropriated. Following are the names of the winners in the other contests: One hundred-yard dash, first, G. A. Binder; second, T. D. Montgomery. Fifty-yard dash, first, Miss Holland; second, Mrs. C. B. Schmal; third, Mrs. V. A. Sweet. Three-legged race, second, Vose and Rockwell; third, Stanton and Binder. Potato race, first, Mrs. W. H. Coleman. Ball-throwing contest, first, Miss Holland. Fat men's race, third, G. H. Porter. Hobble-skirt race, first, Mrs. Kadie; second, Mrs. C. B. Schmal. Author-guessing contest, first, Miss Lena Taussig; second, Mrs. C. B. Schmal; third, Mrs. L. Gold. Attendance-guessing contest: Mrs. C. B. Schmal, Miss Marjorie Lee, I. L. Quarles, R. T. Hensel, G. W. Cravens, J. Dolliver and R. Mueller. Bean-guessing contest: Mrs. G. W. Cravens, Miss Anna Jones and Mrs. N. W. Lancaster.

Following the concert by the New York Symphony Orchestra, of which Mr. Walter Damrosch is leader, the special train returned the party to Chicago.

The Engineer as a Professional Man.

Mr. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, delivered an address at the commencement, June 15, of Clarkson School of Technology, Potsdam, his subject being "The Engineer as a Professional Man."

One of the most valuable assets in any professional or business career is, he said, tactfulness, and to no one is it of greater value than to the engineer. His theory may be all right, his plans may be excellent, his project may be well conceived and carefully thought out, but it may be presented in such a way that it will not appeal to a superior officer, a commission, or a board of directors. Natural difficulties may be overcome by technical skill or by sheer force of energy and persistence, but prejudices and antagonisms may be aroused which will prove insurmountable. In dealing with men as with nature, it is well to follow the lines of least resistance. If incredulity be met with scorn, if irrelevant questions be ignored or answered with contempt, if objections be treated with impatience, the best matured plans are apt to come to naught.

When a moral principle is involved, the man who will stand or fall by it is always to be commended, and the instances are rare in which he will not win. It is well to get the best we can under the circumstances. The man who will do this is an opportunist. Most men who attain results are opportunists. In fact, it may be said that the tactful man is courteous, considerate of others' opinions and even of their prejudices, is willing to go around rather than through an obstacle, and is an opportunist.

To make success substantial and well worth attainment, one other qualification is necessary, and that is integrity. Not honesty which is merely good policy, not a relative degree of rectitude which is measured by that of other professional or business men, but a devotion to the highest ideals of truth, honor and justice.

The engineering profession is an exacting one; he who follows it deals with natural laws, the infraction of which means disaster; his deductions must be based upon premises which are incontrovertible and which can lead to but one conclusion; polemics and casuistry have no place in his mental equipment. His moral nature should reflect his mental habits, and in all his relations there should be no compromise between truth and falsehood—between uprightness and moral obliquity. It may be said that the professional standard implied by the qualities and habits just enumerated is very high and beyond the reach of most men. It is high, but it is not beyond the reach of any man who is determined to attain it.

For the man who would most effectively serve the public and who would emphasize the dignity and importance of his profession, still more is necessary. The engineer with the liberal training, the importance of which is emphatic, will readily appreciate the necessity of making his work as attractive in appearance as is consistent with utility and economy. Symmetry of form, harmony of color, and consistency in detail, do not necessarily involve additional expense. The American people are coming to realize that beauty is a valuable asset. The engineer must train his own taste in such matters, and he should also be willing and anxious to collaborate with the architect and the artist in order to produce satisfactory results.

Proper equipment for the highest usefulness in the engineering profession depends in large degree upon the use a young man makes of his opportunities during his professional course. The results depend chiefly upon the man himself. The student has the best opportunity to gain that inspiration from the teacher which close personal contact is likely to promote.

Thorough preparation is essential to one who would gain the maximum of benefit from his professional course. There was a time, not many years ago, when engineering was scarcely considered as a profession. That time has passed; engineering is now recognized as the great creative profession, and its dignity and emoluments have correspondingly increased. Engineers should insist that it also be classed as one of the learned professions. The profession is an intensely practical one, but there is every reason why the engineer should be an idealist, provided he is not a doctrinaire.

Convention of Acetylene Association.

The thirteenth annual convention of the International Acetylene Association was held in Chicago from Aug. 3 to 5. Among the papers were two of especial interest to electrical engineers.

MECHANICAL SUBSTITUTE FOR SELENIUM CELL.

A mechanical device for controlling gas valves or other apparatus, turning on the low with the advent of darkness and extinguishing the light with returning daylight, was described by Mr. James Pattison, of Philadelphia, Pa., before the thirteenth annual convention of the International Acetylene Association, held at Chicago, Aug. 3 to 5. The device in its present form is of chief utility for controlling acetylene or gas-lighted buoys or harbor lamps, extinguishing the flame during the daytime and thus working a saving of almost one-half in the gas consump-

tion and attendance necessary for replenishing. The principle of its operation is the difference in expansion between rods of the same material, one rod being gold-plated and polished to render it highly reflective, and the other rods blackened to make them absorb all incident rays. As constructed, three blackened copper rods form the frame of the apparatus, in the center of which the gold-plated rod expands against the short arm of a lever fulcrumed on the frame. The expansion of the blackened rods, having their temperature raised due to absorbing more heat or converted radiant energy, is multiplied by the motion of the lever arm which opens and closes a gas valve. As all the rods are of the same material and undergo the same expansion due to the actual temperature of the air in which the apparatus is placed, the "photostat" is equally sensitive winter and summer and is affected only by radiant heat or light. This method of control is now being experimented with by the Government lighthouse service along the Connecticut coast, and buoys are said to remain in operation a year without attention or replenishing.

Evidently, by substituting an electrical contact for the gas valve in the apparatus, the light-controlled operation of any motion could be accomplished in a manner similar to that effected by the selenium cell, without some of the latter's inherent disadvantages due to high resistivity and relatively small resistance change.

AUTOMATIC STREET LIGHTING.

In a paper on "Automatic Street Lighting," read by Mr. W. A. Cochrane before the acetylene men, he expressed dissatisfaction with present methods of automatic ignition of gas street lamps, remarking that the solution of this difficulty would make the brilliant acetylene flame an active competitor with electrical systems. For acetylene lighting, the maintenance of pilot flames has proven too expensive, and an electric spark coil has been resorted to, with a battery, at each lamp. Using the "two-pipe" system, by which the street lamps are supplied with gas from separate mains from those furnishing gas to householders, a liquid-sealed gas bell is provided in each lamp. To ignite the lamps, the pressure is momentarily raised by several inches of water pressure, causing the bell to rise and open a valve to the jet, at the same time bringing together, in its travel, the two contacts of the local kick-spark coil in series with a pair of dry cells. The spark produced ignites the gas. Inventors are seeking to find some way by which such automatic operation can be secured in a system where street lamps and consumers' private lamps receive gas from the same mains without affecting the customers' lamps.

Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission has issued an order approving the application of the Salem Gas Light Company for authority to issue 1500 shares of new capital stock of the par value of $100 each, at a price of $140 per share, as determined by the board of directors, to meet the cost of plant additions. The commission has issued a finding authorizing the Taunton Gas Light Company to supply gas in the town of Berkeley. The board has approved the application of the Marlboro-Hudson Gas Company for the right to issue 2000 shares of new stock at the price of $100 per share, as determined by the directors, to meet the cost of plant additions. Consumers of the service of the Plymouth Gas Light Company have petitioned the board to reduce the prices of the company. No hearings are assigned for the remainder of the month, but on Sept. 15 the board is scheduled to give a continued hearing upon the transmission of electricity in Massachusetts, in accordance with Resolve 55, Acts of 1910.

The Middlesex & Boston Street Railway Company has petitioned the Railroad Commission to approve an extension of the time during which a charge of 1 cent may be made for a transfer issued on the lines formerly operated by the Newton Street Railway Company. The company maintains that the income from its service is not capable as yet of giving a reasonable and proper return upon the capital actually invested.

The Massachusetts Gas & Electric Light Commission is now making plans for carrying out the provisions of the new Boston smoke law, passed by the Legislature of 1910. By the terms of the act (Chap. 651) the regulation of smoke is placed under the jurisdiction of the commission within a considerable portion of the Boston metropolitan district. Inspectors are to be appointed by the board as may be necessary, and additions may be made to its clerical staff. The new law provides for time limits of smoke emission from classified chimneys, stationary and locomotive, the smoke being graded according to the Ringelmann chart system. The requirements are to be stiffened each year until 1913, when the full force of the restrictions will be imposed. In the law of 1910 the plants of public service corporations are included in the regulation of smoke. It is planned to improve the economy of fuel consumption so far as practicable in connection with the abolition of the smoke difficulty. The board is required to give public hearings upon complaints relative to smoke matters and its orders are to be clothed with full power to improve any unfavorable conditions. The commission also will have authority to grant permits for the emission of smoke for stated periods, in order to facilitate changes in plant design which may be calculated to better the operating conditions. Land, marine and locomotive stacks are included in the regulation specified by the new law.

Maryland Commission News.

Unable, because of lack of funds, to proceed as it would like to do, the Maryland Public Service Commission is now wrestling with the problem of trying to devise an economical method for carrying out the provision of the law which imposes on it the duty of testing, through its own inspectors, the electric meters in use throughout the entire State. Mr. Louis M. Duvall, the secretary of the commission, when asked last week when the commission would begin the inspection of the meters, said: "Because of the sensitiveness of the instruments it is impractical to inspect the meters before they are installed. I do not mean to say that they cannot be inspected or tested as they come from the factory, but they are so delicate that they are always liable to be knocked out of adjustment during transportation. Now, if the commission is compelled to send its inspectors all through the State in order to inspect and seal the thousands of electric meters now in use, the expense will be so great as practically to exhaust our appropriation. Therefore, it seems that some more economical method must be devised. The New York Commission has exactly the same trouble, I was told. There they have solved the problem by compelling the electric companies themselves to calibrate the meters after installation and then make sworn returns to the commission. Later, if any complaint is received, the commission sends one of its own inspectors to ascertain the cause of the trouble. I was told that this method proves very satisfactory and our local commission may adopt the same system."

For the present the various electric companies throughout the State must equip testing plants for the commission. Superintendent of the Department of Lamps and Lighting of Baltimore, Mr. Robert McCuen, has had several inquiries as to the cost of the city's testing plant, which is one of the best in the country. The Consolidated Gas, Electric Light & Power Company has asked about it and so has a company in Cumberland. It will be for sale after all of the work of testing has passed completely out of the hands of Mr. McCuen. About five employees handle the work for the Baltimore department, and the saving of their salaries will help somewhat in the city's share in the expense of the Public Service Commission. Mr. McCuen will simply have charge of the illumination of the streets in the future.

The United Railways of Baltimore replied last week through its attorney, Mr. J. Pembroke Thom, to the complaint of certain residents of Ellicott City filed with the Public Service Commission, that the fare between that point and Baltimore is excessive. It is stated that the leading merchants of Ellicott City are opposed to a reduction in the fare. In its reply the

United Railways does not admit the jurisdiction of the commission to reduce the existing fare. At the same time the company makes a general reply to those seeking a reduction. The maximum fare between the two points is 15 cents, including transfer privileges in Baltimore. The fare was thought to be excessive on account of the 10-cent fare charged on the Catonsville line and on account of the fact that the residents of the latter suburb get the benefit of a commutation book which makes the trip cost about 7.5 cents. It was also claimed that the railroads make the trip to Ellicott City for a smaller fare than the United Railways charge. As to the latter argument, the United Railways informed the commission that it operates 10 times as many cars between the two points as the railroad company, and, therefore, it is necessary to make the additional charge. In the reply it was pointed out that the passengers were conveyed to any part of the city by their transfer privilege, which, of course, was not afforded them with the railroad. The railway company also showed that there was no comparison with the conditions on the Catonsville line. The bulk of traffic on the Ellicott City line originates at Ellicott, while the Catonsville line has several points along the line that cause additional traffic. The company admits the sale of commutation tickets to the residents of Catonsville, but claims that the making of this rate has proven to be a mistake.

In general terms the electric railway company says that the revenue per capita is decreasing, while the expense per capita is increasing in the operation of its lines. One item in the increase, it was pointed out, is the increase in the cost of labor and material.

New York Commission News.

After many months of hearings, the Public Service Commission of the First District of New York last week handed down a decision in the matter of the reorganization of the Third Avenue Railroad Company. The application for this reorganization was made by the Bondholders' Committee last December after a previous proposition had been turned down in September. The new application, which is the one that has just been acted upon, proposed a plan of reorganization which scaled down the capitalization several million dollars. The Public Service Commission, through an opinion written by Commissioner Milo R. Maltbie, denies the application and indicates that the reason for the denial is that the proposed new capitalization exceeds by a considerable amount the actual value of the property. In round numbers, the reorganization committee proposed that the new company issue $15,790,000 first refunding mortgage bonds, $16,590,000 capital stock, $22,536,000 adjustment mortgage income bonds. This made a total capitalization of more than $54,000,000 and the commission held that upon this amount of stock and bonds no adequate return could be made from the earnings of the company. The reproduction value of the Third Avenue property as figured out by Mr. E. G. Connette, transportation engineer of the commission, is $42,907,816 and the present value of the property, charging off depreciation, is only $31,100,125. While the commission indicated that a modified plan or one which came nearer in its capitalization to meeting the ideas of the commission would be sanctioned, it decided positively that a plan which contemplated capitalization far in excess of the engineer's estimate of the value of the property would not be approved.

An order was issued last week by the Public Service Commission of the First District directing the receiver of the Metropolitan Street Railway Company and the receiver of the Fifty-ninth Street, Central Park, North & East River Railroad Company to make transfers at points where the two lines intersect. Transfers were formerly made on the Fifty-ninth Street line at every point of intersection with any other surface line, but after the company went into the hands of a receiver these transfers were abolished. Under the present order the Fifty-ninth Street line will transfer to all lines crossing it between First Avenue and Tenth Avenue.

During the past week a communication has been sent to the Public Service Commission by the Citizens' Union advocating the construction of subways by assessment of the property which would be benefited by the construction. In a long letter the Citizens' Union takes the ground that subways through sparsely settled districts are not likely to be remunerative in operation and that, therefore, it is not right that the city should pay for the expense of construction in such districts or for the expense of operation. A letter was also received during the past week from Mr. Samuel Rea, second vice-president of the Pennsylvania Railroad Company, urging the construction of a subway system down Seventh Avenue, and suggesting that it is a much better plan to permit the Interborough Rapid Transit Company to extend its present subway system along the lines which were proposed than to build a separate outside tri-borough system.

Some friction seems to have arisen between the Public Service Commission and the Board of Estimate as to the terms or forms of contracts which are to be advertised for the tri-borough subway system. The engineers of the Board of Estimate are opposed to certain provisions of the tentative form of contract as drawn up by the commission. These objections, while merely technical, may result in delaying the advertisements for bids for an indefinite length of time.

The terms for the extensions and improvements which are asked by the Interborough Rapid Transit Company, involving the third-tracking of the present elevated structures and the connection with the Queensboro Bridge are for 999 years, or in other words, for the life of the present franchise. Mr. Theodore P. Shonts, president of the Interborough company, has indicated that these will be the only terms upon which his company will seek to construct extensions. It is not believed that the commission will approve any such lengthy franchise.

The Public Service Commission has approved an application of the Second Avenue Railroad Company for equipping electrically its line through Worth Street from Chatham Square to Broadway. The franchise for this line has been owned by the Second Avenue Railroad Company for many years, but the road has not been operated since the days of horse cars because the Second Avenue Railroad Company did not need it. When the Second Avenue line was a part of the Metropolitan system a downtown terminal was furnished through Park Row to the Post Office by the use of the Metropolitan tracks. Since the Second Avenue Railroad Company has been under a separate receiver and has no longer anything to do with either the Metropolitan or the Third Avenue systems it has had no downtown terminal and the electrification of this small piece of track is intended to furnish it with such a terminal. In granting the request of the Second Avenue company for this electrification, the commission required that the company abandon quite a number of streets on which tracks are now laid, but which have never been electrified and are not used.

The Public Service Commission for the Second District on Monday, at Albany, continued the hearing upon an order which directed and required the Dwass Electric Company, of Schenectady, to show cause why it violated certain terms and conditions of the authorization to capitalize previously granted by the commission. On Tuesday, at Albany, the commission entertained the petition of the Southern New York Power Company under section 69 of the Public Service Commissions law for authority to issue $40,000 in common capital stock. The commission has received applications from the Fonda, Johnstown & Gloversville Railway Company for permission to exercise a franchise for the building of a double track along East Main Street in Amsterdam and an extension of a single-track line to the Eighth Ward. Through cars of the petitioner between Gloversville and Schenectady now run on East Main Street, and the double-tracking will facilitate their operation. This company also filed its petition for leave to issue $463,000 in 6 per cent bonds, the balance of an issue of $7,000,000 which was authorized by the Board of Railroad Commissioners in 1903. The proceeds are to be issued to pay off existing obligations and the cost of the double-tracking and Eighth Ward extension.

CURRENT NEWS AND NOTES.

Ohio Convention Attendance.—An analysis of the registration of the Ohio Electric Light Association at Cedar Point July 26 recently made by the secretary, shows that 61 central stations were represented, and there were 156 representatives from those stations in attendance. The analysis brings out the point that a larger number of members from each company are attending these conventions than formerly.

Constantinople Electric Railway.—United States Vice-Consul-General Oscar S. Heizer, of Constantinople, has forwarded to the Department of Commerce and Labor specifications and conditions governing a concession to be granted by the Imperial Ottoman Government to the most favorable bidder for a system of electric tramways in Constantinople and suburbs. Bids for this concession will be received at the Ottoman Ministry of Public Works until Oct. 15, 1910.

American Hydroelectric System in Cuba.—All of the equipment for the hydroelectric generating installation on the Hanabanilla River and the distributing system owned by the Cienfuegos, Palmira & Cruces Railway & Power Company, which has started the work of construction in Cienfuegos, Cuba. will come from the United States. The material will include not only the hydraulic and electric machinery, but the cars, rails, iron pipe and vitrified clay pipe to be used in a water works and sewerage system.

Coal Output in British Columbia.—United States Consul Frank C. Denison, of Fernie, in his annual report states that during 1909 there was a decrease of about 200,000 tons in the output of the coal mines of that Canadian district, as compared with 1908, caused by the suspension of operations in the Crow's Nest district during April, May and June, owing to a disagreement between the owners and miners. The total output in 1909 was about 1,750,000 tons. The output at the Fernie and Michel mines now averages about 5000 tons daily.

Trains in Pennsylvania Tunnels.—The Pennsylvania Railroad will inaugurate its New York tunnel service on Sept. 8, at which time the trains on the north shore division of the Long Island Railroad will transfer passengers at Winfield, where they will be carried in electric trains to New York City. On account of certain regrading and retracking not having been completed through trains will not be operated over the division before next year, when an 18-minute express service will be run between Jamaica and New York City.

Electricity Represented on Capitol Bronze Doors.—One of the eight panels of two bronze doors being placed at the west entrance to the Capitol at Washington has for a decorative subject "Iron and Electricity." On each side of a scene of iron and electrical workers are figures of Peter Cooper and Henry A. Rowland, and medallions show Edison and Baldwin, founder of the Philadelphia locomotive works. In the engineering panel one of the medallions shows Roebling, builder of the Brooklyn bridge, and Cyrus W. Field is the subject of a medallion in the naval architecture and commerce panel. The science panel contains a figure of Prof. Oliver W. Gibbs and medallions of Joseph Henry and Alexander Graham Bell.

Derailment of Elevated Train in Boston.—An unusual accident occured on the elevated lines of the Boston Elevated Railway Company at 1:09 a. m., Aug. 4, when a train in charge of an experienced motorman, making a yard movement near Dudley Street terminal, became unmanageable and was derailed near a switch tower at the corner of Washington and Dudley streets. Two of the four cars composing the train fell into the street and the motorman was killed. There were no passengers aboard. The cause of the accident is unknown, but it is possible that the motorman had a fainting attack and fell upon the controller handle in such a way as to keep it in full multiple. All the cars were equipped with multiple-unit control, and the company's system of inspection is most thorough. The damage to the company's rolling stock and elevated structure is estimated at about $25,000.

Comparison of Lignite and Coal for Fuel.—The Canadian Water, Light & Power Company, of Canadian, Texas, is installing two gas producers and two 13-in. x 12-in. three-cylinder vertical gas engines, each belted to a 50-kw electric generator. It is the intention to operate the machines in parallel when the load requires doing so. A Colorado or New Mexico bituminous coal will be used for fuel, as this coal can be purchased for from $4.25 to $4.50 per ton, while the local Texas lignite costs $3.75 to $4 per ton. The freight cost on lignite, however, is higher than on coal from out of the state. Considering the higher heating value of the coal, it is believed that it will be more economical than lignite for fuel. However, after the plant is in operation experiments will be made with a car of lignite in comparison with bituminous coal, continuous records being kept of all quantities, including the amount of water used, in addition to the fuel efficiency. Mr. C. W. Conrad is manager of the company.

American Trade in Hungary.—In a review of trade at Budapest for the year 1909, United States Consul-General Paul Nash describes the various handicaps encountered by all dealers in American goods by reason of the lack of direct communication. He claims that the retailer trying to buy goods from an American manufacturer is almost invariably referred to an export agent in New York or an import agent in Hamburg. If he then addresses himself to the New York jobber he is generally supplied through the Hamburg agents of the jobber. The result of this roundabout way of doing business is that the average retailer prefers to carry German or Austrian goods, which he can secure in small quantities directly from the factories. The profits of the New York exporter and the Hamburg agent often reduce the margin of profit of the retailer to the vanishing point, or make it necessary to sell at such high prices that the disposal of the goods becomes problematical. With the increased facilities for shipping directly from New York to Fiume, Budapest should be the best distributing point for the Balkan States, but now Roumania, Servia and Bulgaria get their supplies of American goods principally from Hamburg.

American Equipment in Japanese Railways.—Four new trolley lines have been opened recently in the Kobe district of Japan. Four miles of the Kobe Electric Company's line, which will be 18 miles in length, have been opened for service. The generator, rails, poles and air brakes are American, the running gear and machinery of cars English, and the woodwork of cars and overhead wires Japanese make. The Minomo-Arima Electric Railway Company's 18-mile line to mountain summer resorts opened recently. The rails, generators, boilers and running gear and machinery of cars are American, the woodwork of cars and overhead wires Japanese make. The Keihan Electric Railway has opened a line 28 miles long, connecting the important cities of Osaka and Kyoto, and running through other large towns. Nearly all of the materials came from England, though the overhead wires came from the United States, while the woodwork of the cars was made in Japan. The Keishin Electric Railway, from Kyoto to Otsu, and the Uji Electric Railway, from Fushimi to Uji, now building, will connect with this line. The Hyogo Electric Railway has opened its first section—from Hyogo to Suma; it will extend 12 miles along the shore of the Inland Sea to Akashi. The material has come chiefly from the United States, the woodwork of the cars and the overhead wires being made in Japan.

Electrification of Bavarian Railways.—For the purpose of installing a hydroelectric equipment at Lake Walchen for generating energy for the complete system of State railways, the Bavarian Diet has voted $1,500,000 as the first installment. Additional appropriations will be made annually.

German-French Cable Deal.—It is reported that the German and French cable lines have entered into an agreement whereby they are to work together intimately, to use each other's lines in case of interruption, and otherwise to enjoy the advantages of a "community of interests."

Baden Hydroelectric Station.—The Diet of Baden, Germany, is planning to expend $6,500,000 for the establishment of a hydroelectric generating station in the Murg Valley above Forbach, to supply electricity for the state railways and for the state harbor at Mannheim.

Decrease in Southern California Edison Assessment.—The Los Angeles Board of Equalization has made a reduction of $100,000 in the assessed valuation of the Southern California Edison Company franchise to do business. The reason reported for the reduction is the unstable character of the company's stock during the past four months.

Wireless vs. Wire Telegraphy.—The Postmaster General of Argentina is reported to have submitted to the Government a scheme to replace the telegraph system of the country by wireless telegraphy, declaring that atmospheric conditions in Argentina are more favorable to wireless telegraphy than in any other country and that messages are transmitted to distances never reached in Europe.

Fast Signal Equipment Work.—A remarkable record for rapid installation of signal lines was reported on the Indiana division of the Baltimore & Ohio Southwestern Railroad last month when 183 miles of block-signal wire was strung by three gangs in seven days. The territory thus equipped extends from Storrs to Vincennes and from North Vernon to New Albany, and includes 62 offices.

Practical Telegraphy Competition.—The Minister of Posts and Telegraphs of Italy has decided upon an international competition in practical telegraphy during the Turin exhibition next year. The competition will be open to telegraphists of the whole world. Morse, Hughes and Baudot instruments may be used. All governments adhering to the International Telegraph Union, the Imperial Chinese Telegraphs, and the principal private telegraph companies will be invited to co-operate.

German Incandescent Lamps.—Germany's exportation of incandescent lamps has steadily increased since 1901, in which year it amounted in value to $664,000; in 1907 to $2,000,000; in 1908, $4,780,000, and in 1909, $7,856,000. The exportation during the first quarter of 1910 was valued at $3,775,000, against $1,737,000 for the corresponding three months of 1909. This increase is due to enlarged shipments to Great Britain, Austria-Hungary, Argentina, Russia, Denmark and Italy.

Electric Fans on Street Cars.—Motor-driven ventilating fans form part of the ventilating equipment of 12 new street cars just put into service on the West Twelfth Street line of the Chicago Railways Company. These cars are the first of an order of 350 which will be similarly equipped. The motor-driven fan forces 20,000 cu. ft. of air an hour up through electric heaters, which will warm it in winter, insuring a fresh supply of pure air in all parts of the car.

Government Control of Wireless.—In his annual report, Rear Admiral Schroeder, commander-in-chief of the Atlantic fleet of the United States Navy, urgently recommends government control of all wireless plants. The Admiral says his flagship frequently took 200 messages a day, but the work was needlessly interrupted by commercial operators and schoolboys with amateur plants on shore. At times the wireless operations of the fleet were completely suspended.

Wireless in Africa.—The extent of wireless communications in north and northwest Africa can be judged from the fact that wireless telegraphy stations have already been established at Oran and Bizerta on the north coast and at Port Etienne, Dakar and Rufisque on the west coast. Additional stations are being constructed at Timbuktu, Konakry and Monrovia. The erection of stations for military purposes at Figuig, Loango, Libreville and Brazzaville and at Abeshr in the Tchad region is planned. All these stations will ultimately be linked up with the Eiffel Tower. It is proposed to establish communications by wireless telegraphy between Port Etienne and the South American continent.

Water Storage Project.—The New York State Water Supply Commission has just completed the survey of a site for a storage reservoir in the Black River at Hawkinsville, a village in Oneida County. This village will be completely wiped out by the reservoir. It is proposed to construct a dam 130 ft. high and 1500 ft. long with foundations upon the solid limestone which underlies the site. The type selected is an earthen embankment with a masonry spillway. The survey shows that such a dam would impound nearly 6,000,000,000 cu. ft. of water, creating a lake five and one-half miles long and two miles wide at its widest point, and extending from Forestport to a point a mile below Hawkinsville. The purpose of the reservoir is to regulate the flow of the Black River and studies by the engineers show that in so doing it would be possible to utilize this flow continuously to produce 11,220 hp.

Wireless Telegraphy in New Zealand.—The New Zealand Government has invited tenders for two high-power and three medium-power wireless telegraph stations. One of the former is to be located near Doubtless Bay, in the northern part of the North Island, and the other near Bluff, at the extreme south of the South Island. These two stations are to have a minimum range oversea of 1250 nautical miles, and are to be capable of signaling with the high-power station that is being installed by the Australian Commonwealth near the entrance to Sydney Harbor, and with each other. They are also to be capable of receiving calls from Fiji, from men-of-war at long and short distances, and from commercial vessels. The high-power station at Doubtless Bay is to be the first to be erected. The three medium-power stations are to be erected at Cape Farewell, Gisborne and at Sumner (near Christchurch). They are to have a range oversea of 500 nautical miles. Systems that may be suitable for wireless telephony as well as telegraphy are to receive consideration. The tenders are to be delivered Dec. 15.

Proposed Tax Basis in Favor of Electric Automobiles.—The results deduced by several engineers who have had considerable experience with automobile trucks and commercial vehicles, as well as with pleasure carriages, as recounted at the recent Detroit convention of the Society of Automobile Engineers, indicate that the wear of tires (also the destructive action on the road surface) follows a law in which it is proportional to the product of the square of the speed of the vehicle, multiplied by its mass: $\text{Wear} = \text{speed}^2 \times \text{mass}$. In conjunction with the American Automobile Association, the engineers' society is endeavoring to formulate suggested laws, to be laid before legislatures having the passage of automobile tax bills up for consideration, in which more nearly due account shall be taken of the rational factors entering into the state's charge for the use of the roads. The society, as well as all automobile users, recognize that it is unfair to tax an electric runabout at the same rate as a heavy 150-hp racer capable of running at 90 miles an hour. If some formula can be worked out for the problem, adjusting the tax to the road wear, which increases as the square of the speed and the first power of the weight of the vehicle, the electric automobile will benefit in its tax proportion, from its lighter weight and limited speed.

ELECTRIC PLANT AT MESSINA, ITALY.

Description of the Station Which Survived the Earthquake of 1908.

THE electric plant at Messina, Italy, is of recent creation and is indirectly controlled by the Società Elettrica della Sicilia Orientale, which owns several waterfalls in the eastern part of the island of Sicily. Of the hydroelectric stations which this company contemplates building two are nearing completion and will be placed in service shortly. These are located on the river Cassibile, some 17 km (10.5 miles) south of Syracuse and on the Alcantara, a river running along the northern base of Mount Etna and fed, in its lower course, by the snows of that volcano. These two generating stations are separated about 150 km (93 miles) from each other and will be run in parallel so as to deliver electrical energy over the whole eastern coast area—the richest and the most densely populated of the whole island.

Messina will be one of the many transforming and distributing centers. Meanwhile a steam-generating station has been built in Messina to supply the town with electrical energy until the water-power stations have been completed, and this will afterward serve as a reserve station. As Messina is not an industrial town and a considerable portion of the load is, consequently, lighting load, it was decided to provide the plant with a storage battery, which would permit the installation of smaller generating units. Inasmuch as it was intended at the same time to distribute electricity to the suburban villages and to use afterward the energy coming from the hydroelectric plants, alternating current was adopted for general distribution and this was converted into direct current for supplying of the central part of the town. The plant therefore comprised an alternating-current generating station near the seashore and a rotary converter substation situated in the higher part of the town at a distance of about one mile from the power house.

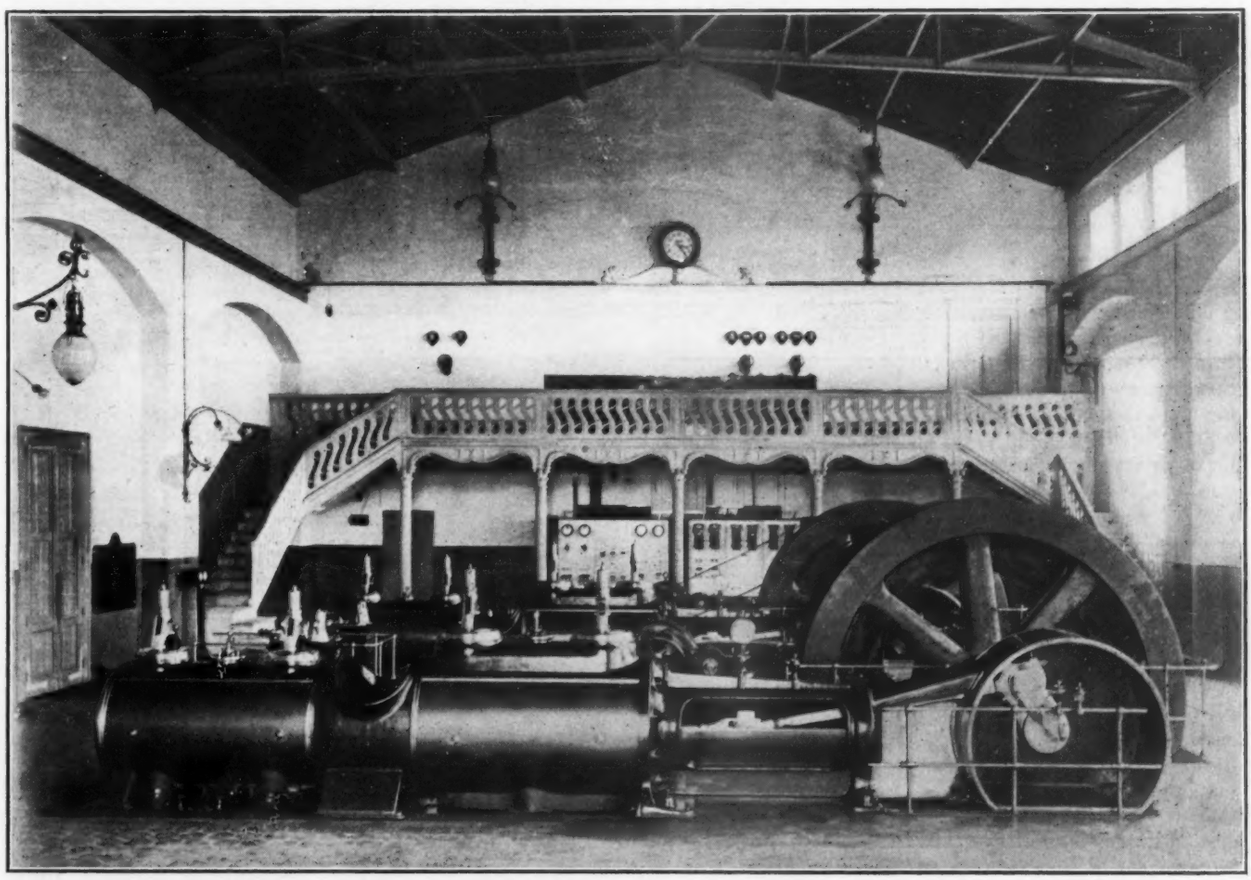


Fig. 1—General View of Generating Room, Messina.

GENERATING STATION.

The general outward appearance of the generating station before the earthquake was just as it is shown in Fig. 4 except that the building was not propped up and the chimney was of masonry and not of iron. The boiler-room (Fig. 5) contains two Babcock & Wilcox boilers with automatic stokers. Each boiler has a heating surface of 170 sq. m (about 1860 sq. ft.) and a superheater of 36 sq. m (388 sq. ft.) producing steam at the temperature of 350 deg. C. (392 deg. Fahr.) and a pressure of 12 kg (170 lb.). On their way to the chimney the products of combustion pass through a Green economizer. There is room for a third boiler of similar rating.

The engine-room (Fig. 1) contains two generating sets, each one consisting of a horizontal tandem-compound steam engine driving a three-phase alternator and a belt-driven exciter. The double expansion steam engines, built by Franco Tosi, of Legnano (Italy) are equipped with Woolf valves and have surface condensers. The full-load rating of each engine at a steam pressure of 170 lb. is 505 hp.

The 48-pole, 50-cycle, three-phase alternators, furnished by the Italian Allgemeine Elektricitäts Gesellschaft-Thomson-Houston Company are of the revolving-field type. The weight of the revolving part is 22,400 kg (50,000 lb.) and the diameter 3.64 m (12 ft.). The rating of each alternator is 345 kw, with 80 per cent power-factor. The tension at the terminals is 5250 volts. Each of the 33-kw exciters is an interpole machine, belt-driven from the outward revolving field of its respective alternator, and runs at the speed of 725 r.p.m., generating current at 150 volts. From this generating station a six-wire, 5250-volt line ran around the town to the rotary-converter substation.

ROTARY CONVERTER SUBSTATION.

The rotary converter substation situated in the high part of the town was a two-story building, the ground floor of which contained a storage battery of 1188 amp-hours capacity with a maximum discharge current of 396 amp, supplied by the General Italian Storage Battery Company of Genoa. It consisted of 276 elements and was connected to a three-wire, 250-volt distribution system. In the small hours of the night this battery supplied the energy for lighting the town, all the machines at the generating station and at the substation being then stopped. Owing to this circumstance no damage was done to the generating station machinery at the time of the earthquake.

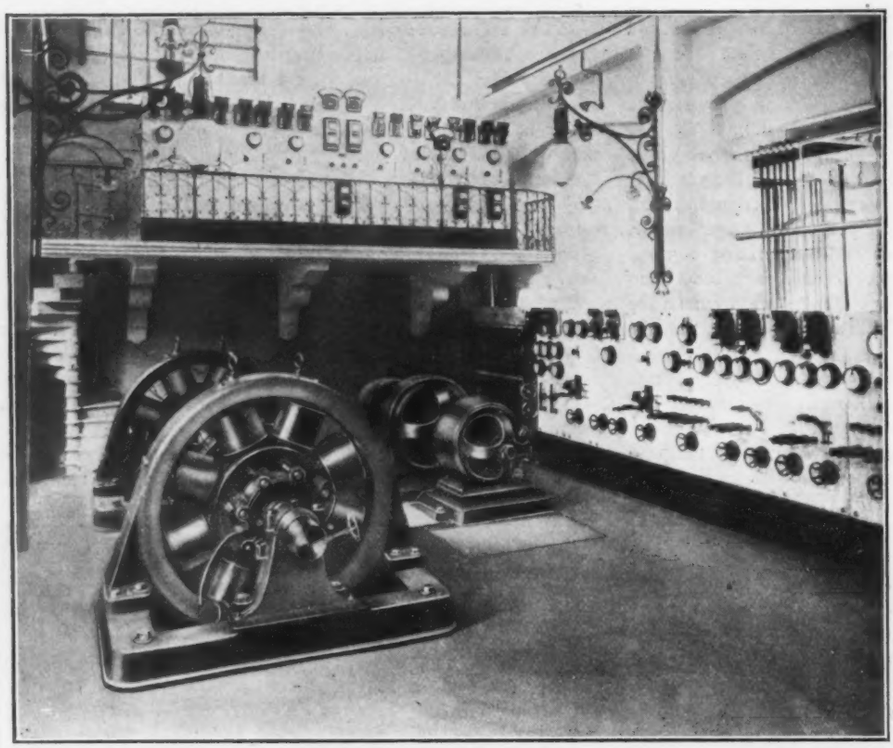


Fig. 2—Rotary Converter Substation.

The electric machinery was situated on the first floor and consisted of two step-down transformers, two rotary converters, one booster set and the switchboard, all furnished by the Italian Allgemeine Elektricitäts Gesellschaft - Thomson Houston Company. The transformers were of the three-phase, oil-cooled type, the rating of each being 240 kw at 5000/330 volts.

The eight-pole rotaries, running at the speed of 750 r.p.m. and generating direct current at a pressure varying from 450 volts to 500 volts, were provided with a special regulating dynamo mounted on the same shaft. The booster set for charging the storage battery consisted of a 100-hp, shunt-wound, 450-500 volt motor driving at the speed of 1000 r.p.m. two shunt-wound dynamos, each one able to give 400/400/300/250 amp at 25/50/87/130 volts. Figs. 2 and 3 give a very accurate idea of the substation.

EFFECTS OF THE EARTHQUAKE.

The plant was put in service in November and was therefore running more than a month, when, early on the morning of Dec. 28, 1908, Messina was completely destroyed by an earthquake and almost the entire population buried beneath the ruins. The distribution network naturally shared completely the fate of the town. The poles, brackets, insulators and wires were either broken, torn, bent and distorted, or buried beneath the huge heap of débris filling all the streets.

The substation was also destroyed in great part. The roof and the floor of the first story collapsed, together with part of the walls. The two rotaries and the booster set fell down on the ground floor, but were not damaged on that account. They suffered seriously afterward, however, having been drenched by heavy and continuous rain before it was possible to take any steps for their protection. The two switchboards, shown in Fig. 2, remained upright, but the marble slabs were broken into small pieces, which were held together by the wiring on the back of the panels. That portion of the building which is shown on Fig. 3 was left with its roof partly in good condition, so that the transformers did not suffer.

In the storage-battery room the elements were upset and lay on their sides still connected up in rows. When one thinks of the great weight of a row of some 90 big secondary cells, all held together by soldered connections and of their slight elevation above the floor level, he can obtain an approximate idea of the enormity of the shock.

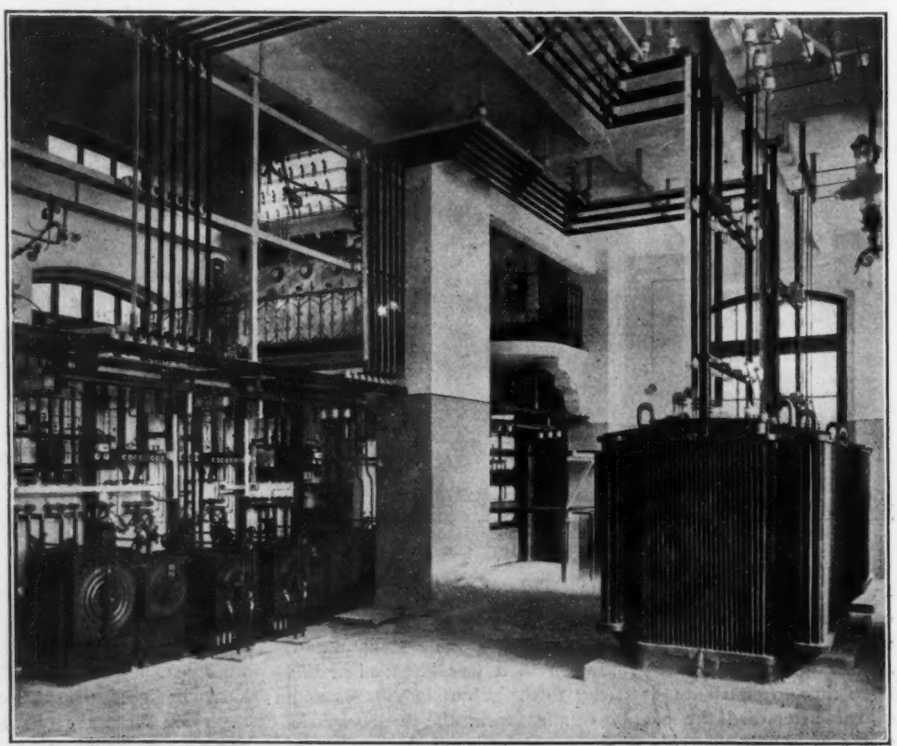


Fig. 3—Rear of Substation Switchboard and Step-Down Transformers.

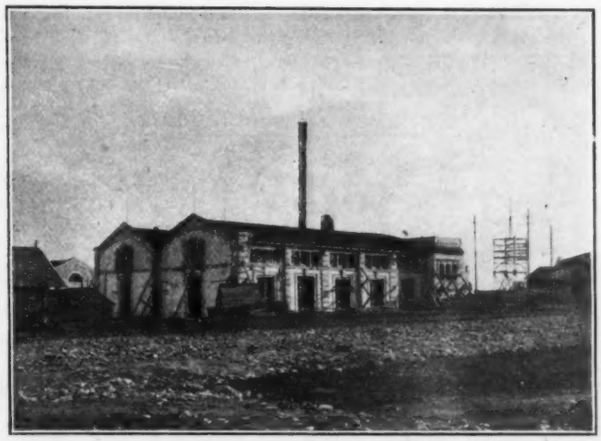


Fig. 4—Propped-up Walls of Generating Station and New Iron Chimney.

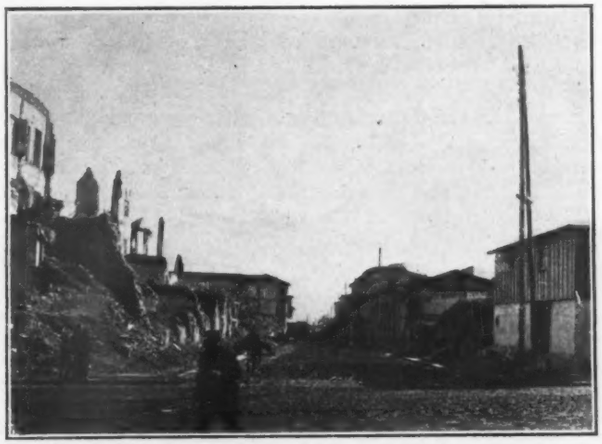


Fig. 7—One of Destroyed Streets Lighted by Arc Lamps.

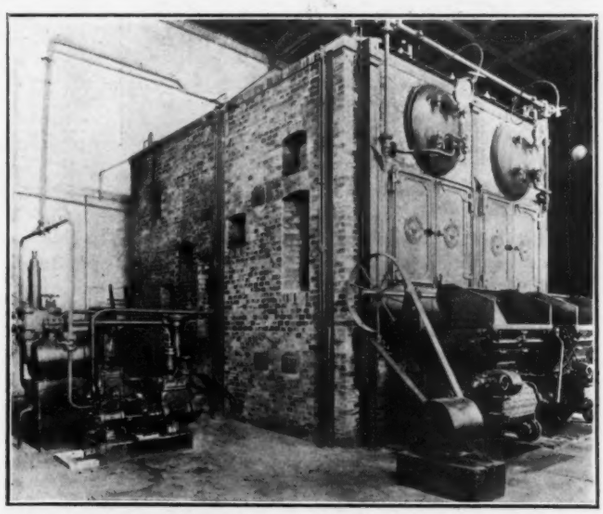


Fig. 5—View of Boilers and Feed Pump.

Fig. 8—Propping Up Cracked Walls.

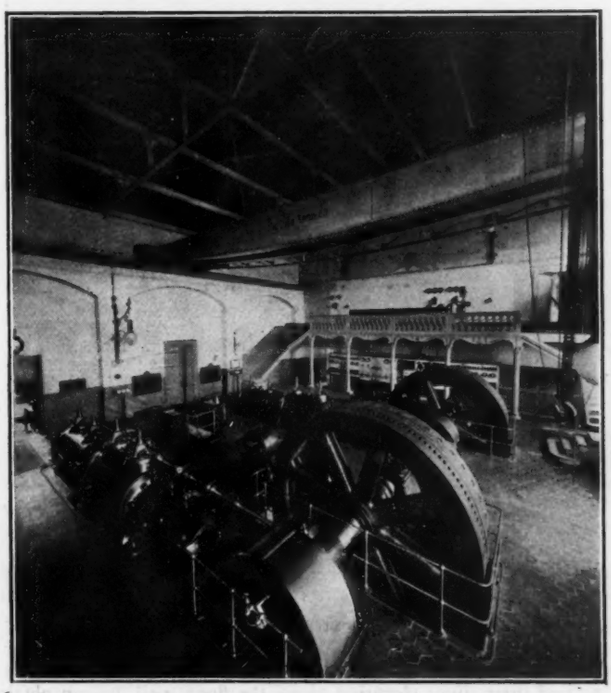


Fig. 6—Repaired Engine Room.

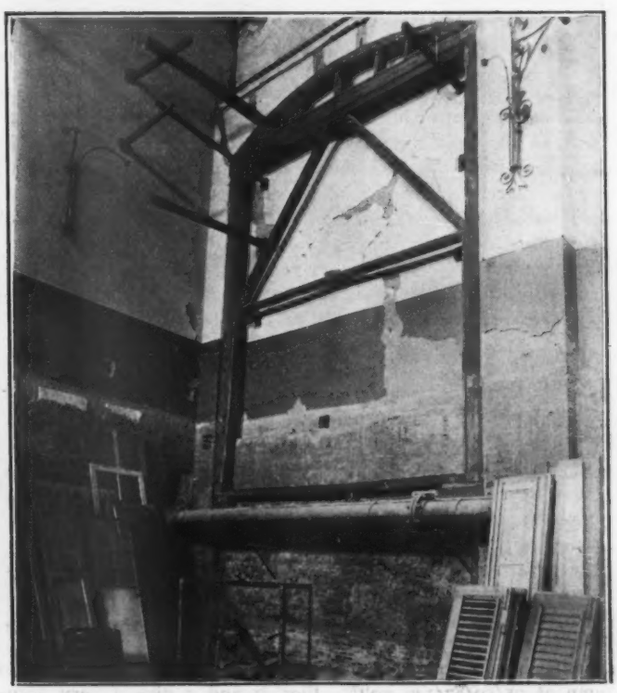


Fig. 9—Method of Sustaining and Repairing Cracked Walls.

The effects of the earthquake on the generating station were not so destructive. They showed some peculiarities, however, from which some indications might be drawn as to the most rational way of building dwellings in countries subject to earthquakes. The masonry chimney fell to the ground shattered to pieces, as shown on Fig. 11. In falling, the mass of bricks went through the roof of the boiler-room, burying completely the economizer and damaging the feed-water pumps.

The ground under the building showed two longitudinal fissures, and the whole building was badly and very dangerously cracked, as can easily be seen by reference to the illustrations. The doors, whether shut or ajar at the time, jammed so as to make it impossible to move them; many keystones were shaken out of place and hung ominously down, and the walls of the engine-room separated almost entirely from one another at the four corners, although remaining perfectly vertical. Notwithstanding all that, the building stood upright as Fig. 4 shows it, except that it was not then propped up and the iron chimney was not then made.

In the basement of the generating station a curious effect was noted. The steam pipes connecting the engines to the boilers were suspended in the air, while the three supporting brackets (only two of which are seen in Fig. 9) were some 12 cm (4.5 in.) below the pipes. This circumstance, together with the fact that the four walls of the engine-room were cracked and separated from one another at the four corners and the presence of fissures in the soil, shows that the longitudinal walls of the engine room sank about 4.5 in. relative to the gable-end walls.

Fig. 10—Street in the "Wooden" Quarter of New Messina.

Not a single piece of piping between the boilers and the engines was broken or bent, and when the alternators were moved by hand they revolved together with the steam engines quite easily and smoothly, thus showing that there had been no relative displacement in the whole block of foundations. The foundations being made of concrete and being, so to speak, fitted with foundation bolts and other iron pieces, so as to bear some semblance—though a very remote one—to reinforced concrete, it seems to the writer a good inducement to use reinforced concrete in all countries subject to earthquakes.

REBUILT PLANT.

The prospects were gloomy enough for the company. The plant seemed irremediably ruined; the distribution net and the substation existed no more, and though the engines and boilers at the generating stations were still in good condition, the switchboard was damaged, the chimney destroyed and the whole power house so badly cracked as to render ingress and egress dangerous. Above all, the town and a population of about 180,000 inhabitants had disappeared. Therefore, the managing director of the company, Mr. Emirico Vismara, deserves really to be complimented for his farsighted faith in the rapid resurrection of the town, which led him to convince the board not to abandon the field, and for the pluck and energy with which he conducted the work of repairing and reconstruction.

The substation, because of its position which rendered the transportation of machinery quite impossible due to the absolute lack of roads, was neglected for the time being, all the efforts being concentrated on the generating station. In order

Fig. 11—Destroyed Chimney of Generating Station.

to begin the service anew as soon as possible, it was decided to postpone the definitive reconstruction of the power house till after the completion of the hydroelectric plant on the Alcantara, when the Messina plant would become a reserve station and when it would be possible to stop the generating sets for a certain time. Meanwhile the building has been thoroughly propped up; an iron chimney has been set up in the place of the destroyed one; the switchboard, boilers and all accessories put in working order again, and a new distribution network supported on wooden poles has been rapidly spread all over the dead city and the new wooden huts, which were rapidly growing from out the soil, so that in June, 1909, the plant was again working in full swing. It has been working now over a year

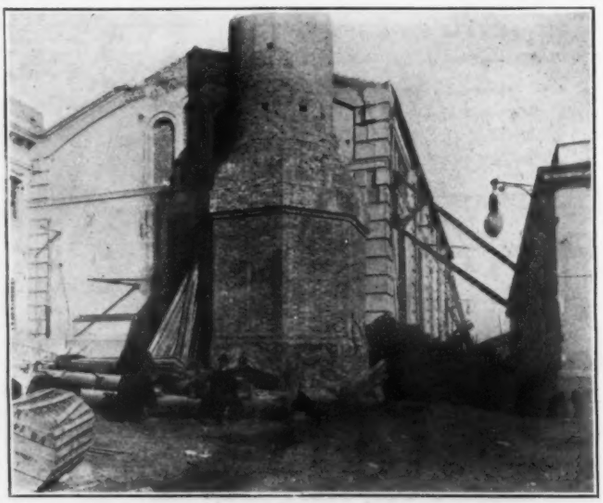


Fig. 12—Reconstructed Base of Chimney and Repaired Roof of Boiler Room.

and not a brick in the propped-up building has moved during that time.

The reconstructed plant works exclusively with alternating current, generated at 5250 volts and reduced to 275 volts in four transformer cabins, the distribution being three-phase with a

neutral wire. One thousand incandescent lamps and 215 flame arcs constitute the public lighting load. Besides these there is

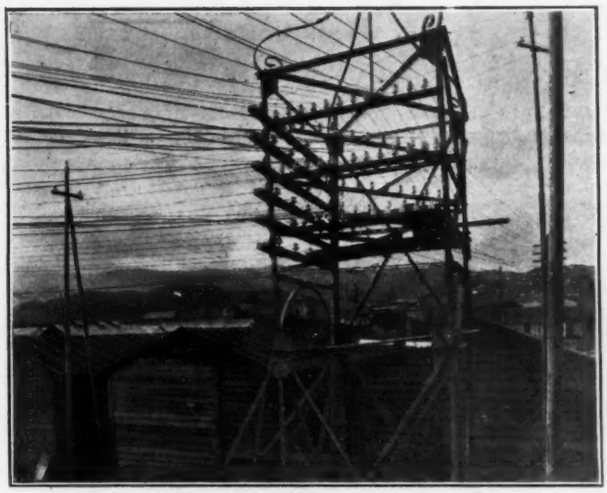


Fig. 13—Tower for Wires at Generating Station.

an ever-growing number of lamps in houses. The distribution network already embraces about 4000 wooden poles, and is steadily growing as the stricken town is gradually waking to new life again. There are now about 60,000 people in Messina. The electric plant has contributed not a little to this rapid development by supplying an easily transportable energy and a safe means of lighting the wooden huts of the new town.

HYDROELECTRIC GENERATING STATION AT TROLLHÄTTAN, SWEDEN.

The Swedish government is carrying out at Trollhättan, a well-known tourist resort, one of the largest power schemes in Europe. After many years of litigation, the government's rights to utilize the waterfalls at that place have definitely been recognized, and by purchasing the interests of a private canal company, which owned considerable sites in the neighborhood of the falls, the government has been enabled to begin the first state power station.

The Swedish government has also obtained control of all the water power available on the Göta River between Lake Vänern

Fig. 1—Trollhättan Falls.

and the sea, by purchasing other falls in the district, so that the power aggregates about 200,000 hp. It is thus also authorized to regulate the water level in the Vänern Lake, so that the best possible results of regulation of water overflow and storage can be obtained.

The generating station now under construction at Trollhättan is intended for eight 12,500-hp generators, of which only four are at present being installed. The electrical equipment, including the transformers and exciters, was built by the Allmänna Svenska Company. The generators are rated at 11,000

Fig. 2—Site of Generating Station.

kva, 25 cycles and 11,000 volts, and are the largest generators yet built in Europe. They are designed to run at 187 r.p.m. and

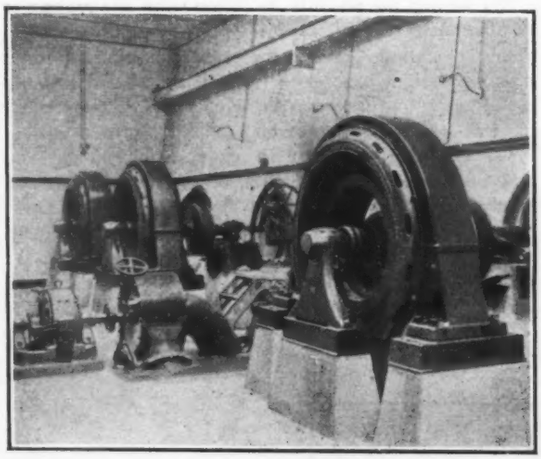


Fig. 3—Small Power Station at Trollhättan.

generate three-phase alternating current. The weight of each rotor will be not less than 65 tons, and the total weight of the

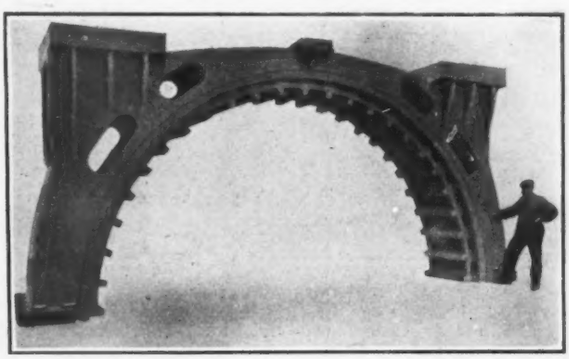


Fig. 4—Lower Half of 12,500 HP. Three-Phase Generator.

generator 160 tons. In order to insure noiseless running, and to keep a constant generator room temperature, the alternators are enclosed. The large quantity of heat developed is used partly to heat the feeder and switch house, and partly to prevent the formation of ice on the racks during the winter. The

necessary air is led to and from the generators in closed air ducts. The lower half of the stator of one of these machines is shown in Fig. 4.

The station is built on a plateau blasted in the rock near the gorge. Above it at some 300 m distant is the transformer and switch house. The connection between these two buildings is made through a blasted tunnel 2 m high, allowing ample room for the inspection of the lead-covered cables, which are mounted on side brackets. All of the instruments and control apparatus, with the exception of the oil switches, are placed in the switch house and operated from there. The main oil switches for each generator are, however, placed in the power station, but are controlled from the switch house. The transformers are of the single-phase, oil-insulated, water-cooled type, and step-up the potential to 50,000 volts, the highest transmission yet employed in Europe.

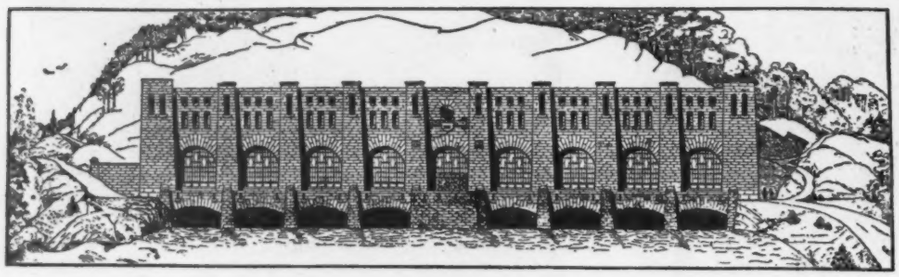


Fig. 5—Exterior of Swedish State Power House.

From the station, besides the local distribution of 10,000 volts, transmission lines go to Gothenburg, 70 km distant, and an equally long line traverses in an easterly direction to Skara, which will eventually be extended still further east. The eastern line is already built with two transformer stations, one at Hakantorp and one at Skara, for 1755 and 1050 kva respectively.

The electric transformer stations, which were built by the Allmänna Svenska Company, receive energy from a small temporary power station at Trollhättan. As soon as the large station is completed these transformer stations will be fed from it. The line to Gothenburg ends in a transformer station rated at 20,000 hp.

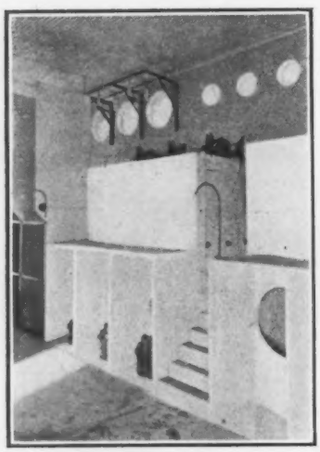


Fig. 6—50,000-volt Transformer Station at Skara.

The Trollhättan hydroelectric generating station is the very first plant in which the ventilation of the generators has been carried out in such a way as to utilize the heat, representing the losses in the generators for utilitarian purposes. The scheme of heating the racks to prevent their clogging with ice during the winter season is not new; but the heat from electrical machinery has never before been used for this purpose.

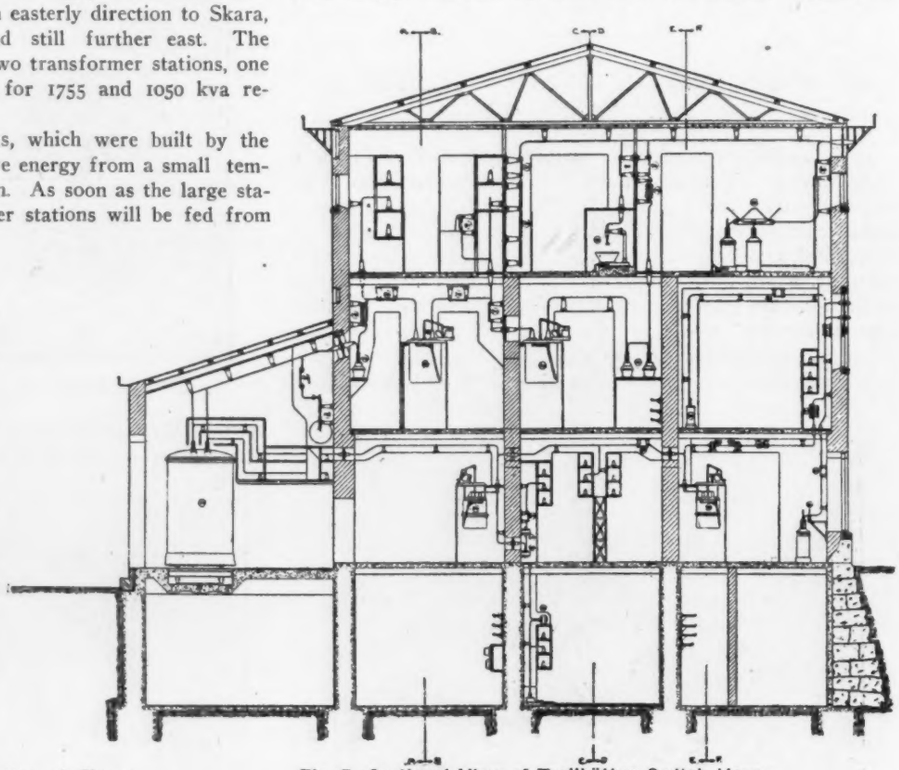


Fig. 7—Sectional View of Trollhättan Switch House.

ELECTRIFICATION OF ITALIAN STATE RAILWAY.

Three-Phase Freight Locomotives of the Giovo Line.

By Warren H. Miller.

THREE-PHASE electric locomotives have been adopted by the Italian State Railways for new lines in process of construction and electrification, mainly because of the favorable experience with three-phase traction on the Valtellina Railway during the last seven years. The extent of new three-phase traction at present laid out under a parliamentary appropriation of 300,000,000 francs, comprises ten lines as follows: Ponte Decimo-Busalla, Genoa Tunnel, Savona-San Guiseppe, Domodosola-Iselle. Gallarate-Arona, Gallarate-Laveno, Milan-Lecco, Bardonnecchia-Mondane, Naples-Salerno, and Pistoja-Bagni della Porretta.

For two of these lines 40 locomotives, mostly freight, have already been ordered, because freight is the main traffic on them. The first of these locomotives was built by the Italian Westinghouse Company in the shops at Vade Ligure and tested on the Valtellina line, because the Giovi line, for which it is intended, was not at that time ready. Since then the Giovi line has been brought to the first stages of practical operation and trial runs have been made over the Genoa section. The tables and data given herein were very kindly furnished by Herr Karl von Kando, engineer-in-chief, whose work in three-phase traction on the Swiss and Italian State lines is well known.

As will be noted from a glance at the illustrations, the mechanical drive is by connecting-rods coupling all five wheels on a side, the center wheel being without flanges and being driven directly by two induction motors acting on its pin through a solid-beam connecting-rod, which receives the torque directly of both motors. To allow for track curves the pins of the central wheels are spherical. The curves negotiated are of

about 1200 ft. radius. The motors are three-phase, 3000-volt, 15-cycle machines arranged to run in series and parallel, giving two synchronous speeds of 112½ and 225 r.p.m., intermediate speeds being obtained by inserting resistance in the circuit.

A limit of 60 tons was set for the actual weight of the locomotive as built, with provision for increasing this to 75 tons by the addition of ballast. Practical operating tests for the amount of actual friction weight required were called for by the specifications, a train load of 380 tons of loaded freight cars being specified as the amount that two locomotives would have to haul up a 3.5 per cent grade on 1200 ft. radius curves, one locomotive pushing and the other hauling. Allowing 60 tons weight to each locomotive, the total weight hauled would then be 500 tons, and, allowing one-fifth the weight of both locomotives for tractive effort, the total drawbar pull would be 24 tons. Heating specifications for the motors give a maximum allowable temperature of 75 deg. C. above air temperature on 117 amp at 3000 volts at the end of one hour's continuous service. This is considerably hotter than would be permissible for such service, continued hour after hour, but in practical railway service it is not unusually severe. The train service tests call for 400 tons for one locomotive on practically level track, no curves less than 550 ft. radius, with thirty stops per hour at a speed of 22½ km, without any undue heating of the motors.

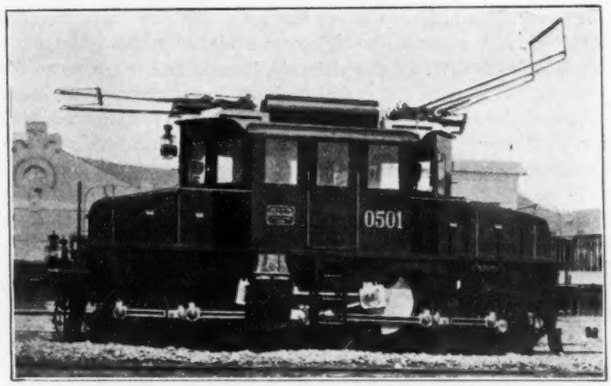


Fig. 1—Three-phase, 60-ton Freight Locomotive for Giovi Line, Italian State Railways.

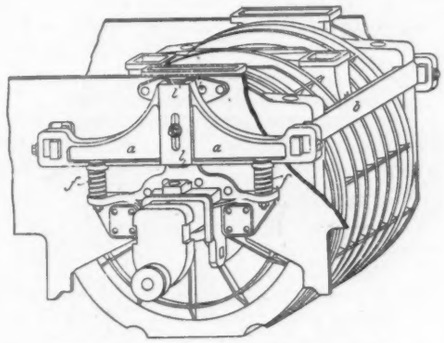


Fig. 3—Three-Phase Induction Motor.

The arrangement of motors for direct drive is worthy of note. The motors have double frames, the outer of which, built into the main locomotive frame, carries the reactions of the frame, takes the thrust of the connecting-rods, and is provided with springs *ff* (Fig. 3) and yoke *aa* to take up all motion or change of position due to shocks, ballast on locomotive frame, etc. The main frame holds the motor proper and has for its function only the maintenance of air-gap, etc., so that the entire motor is virtually independent of all changes of position with respect to the locomotive frame members, being always free to act on the connecting-rod regardless of load and shocks, by virtue of the springs *ff* and guides *ll*. The motors are slipped into place in their outer frames from below by

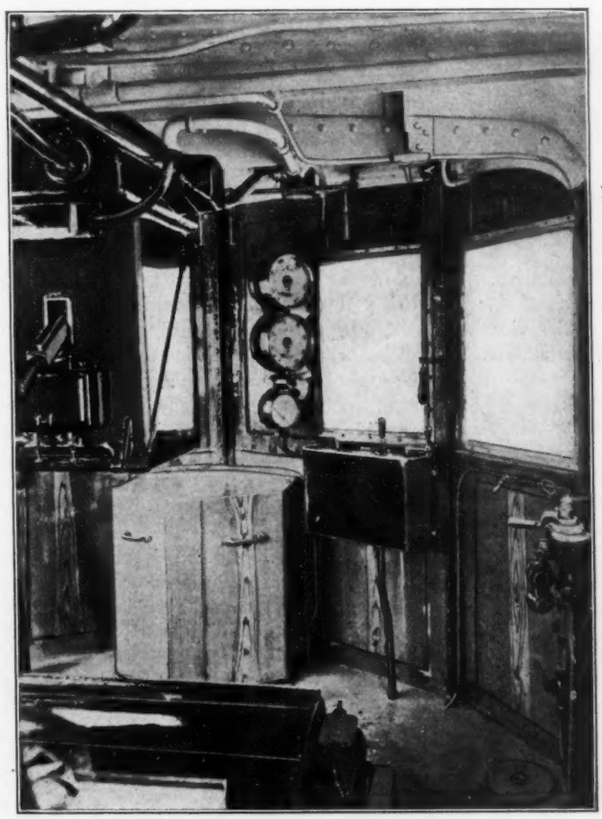


Fig. 2—Interior of Cab—Multiple Control Apparatus.

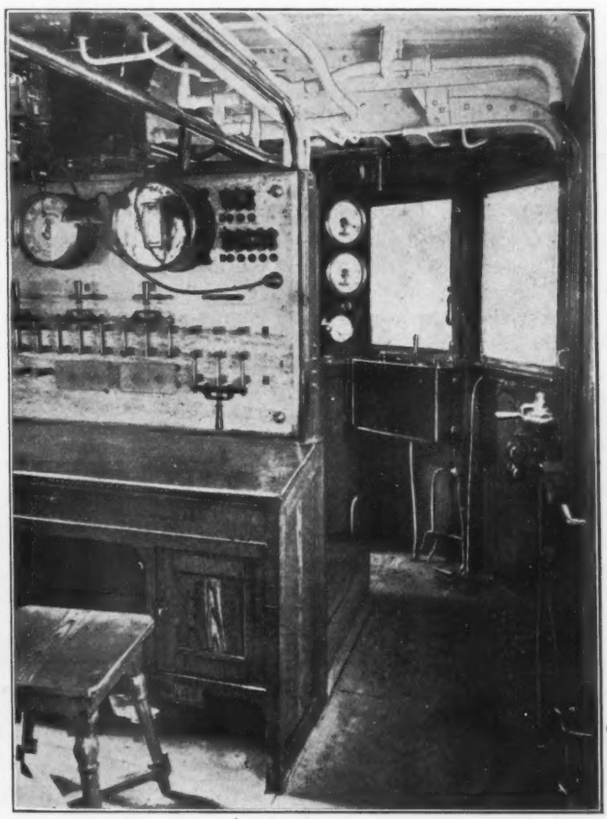


Fig. 4—Interior of Cab—Secondary Circuit Panel.

means of a hydraulic jack. Taking out a damaged motor, including taking off connecting-rods, is not over a two-hour job.

The trolley arrangements are very simple. A single bow engages both overhead wires, the mechanical part of the bow being a steel shaft running in ball bearings between the two arms of the bow, and the electrical part consisting of two hard bronze sleeves over fiber bushings on the common steel shaft, with a completely insulated section of about a foot in the

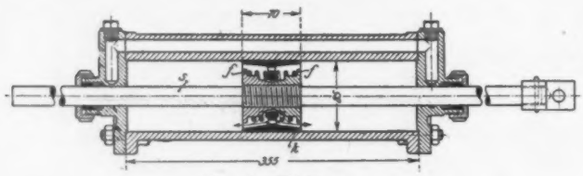


Fig. 5—Oil Damper.

middle of the bow. Energy is taken off each sleeve by suitable brushes and flexible copper leads, and the circuit runs down the motor wires to the insulators as shown in Figs. 1 and 2. The bow arms are double and are hinged at the ends as shown in Fig. 1, so that the bow risers are free to trail in a direction opposite to the direction of motion of the locomotive. The upper stanchion of the bow arm is attached directly to a compressed-air piston, by which it is raised until the bow is in contact with the trolley wire, which varies in height from about 18 ft. to 14 ft. above the track. In maintaining the bow against the wire an oil-damper shown in Fig. 5 is used. As will be seen by a few minutes' study of this device, it will permit a gradual lowering or raising of the bow, because the passage of glycerine through the center of the piston is always free by reason of the small springs on either side of it keeping the piston-rod from closing the valve in the center of the piston. Any sudden jolt or jar liable to knock the bow clear of the wire is resisted by the glycerine, since the small springs are at once compressed in the direction of the disturbance, allowing the piston to lock the glycerine fast, except for the small holes in the web of the piston.

The motor circuit, after leaving the insulators on the roof, passes through lightning-arresters to circuit-breakers and thence to the main oil-switches, which also serve as emergency breakers. From here the circuit leads to a compressed-air-actuated six-point controller, and passes thence directly to the stators of the motors, into each of which is also built a compressed-air-actuated switch, arranged to connect the motors in series or in parallel. This switch also controls at the same time the rotor circuits of both motors, interposing a water rheostat when the motors are operated in parallel, and, when in series, connecting the rotor circuit of one motor with the stator circuit of the other motor. All 3000-volt wiring is run in steel conduit, with cast-iron junction, switch and outlet

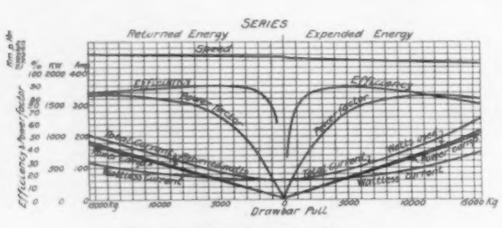


Fig. 6—Performance Curve.

boxes, which are all closed with the same key. This key also locks the trolley-bow mechanism, and cannot be gotten out of the lock except when the bow is down and clear of the trolley wire. By this simple arrangement it is impossible to unlock any of the 3000-volt boxes and get at the wires or fix controller fingers unless the trolley bow is down. Neither can the bow rise to the wire unless the key is back in its lock again. The management of the Italian State Railways considers this simple safety device to be one of the controlling factors in preventing accidents through carelessness on the part of the operating force.

The interposed rotor resistor consists of a kind of variable water and iron rheostat. The resistor bars hang in the upper part of the mechanism, while below them is a tank of water, the level of which can be raised by compressed air. As the level of the water rises higher and higher around the electrodes, the resistor is short-circuited more and more, until, at the highest point, the metal contact keys close, completely shunting the resistor. To control the action of the compressed air, two solenoid mechanisms operate the valves which regulate the entry and exit of the air. The energy supply to one solenoid can be regulated at will, while that of the other is dependent upon the torque of the motors. The water rises or falls as one or the other solenoid has the stronger effect, and thus it is possible to hold the torque and consequently the tractive effort of the motor constant during the acceleration of the train.

The Westinghouse system of air-operated switches performs all the functions of bringing on in regular order all the various switches and resistor controls needed in starting in the desired direction and at the desired final speed, including switching in the motors in series and parallel. A system of multiple control is provided for by a six-wire cable connecting the electromagnetic starting gears for two or three locomotives in tandem, so that one man can start all of them from a single controller which acts on the compressed-air-actuated switches of all the

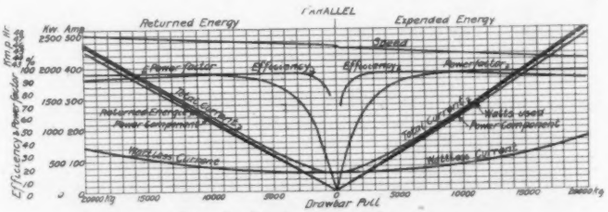


Fig. 7—Performance Curve.

locomotives. It also operates all the resistors by multiple control, a small Stillwell regulator permitting the e.m.f. of the circuits passing through all locomotives to be regulated at will. While the principle of this instrument makes it act equally on all the locomotives in multiple, in practice it is desirable to have some arrangement whereby one locomotive could accelerate at a different rate than the others; for instance, to allow the shoving locomotive to push harder than the hauling one for greater safety of the train couplers. This has been provided for by arranging the regulator transformers with taps.

When the stator of the leading locomotive is in circuit and the rotors short-circuited, the speed of this locomotive becomes the standard of speed for all the others, a very important advantage, because it permits engines of different makes, with old or new tires, or other conditions affecting their speed, to run in multiple control without any one locomotive becoming unduly overloaded, due to reaching its synchronous speed before the others.

To complete the discussion of electrical details mention may be made of the auxiliary compressed-air and air-blast apparatus, located under the front and back hoods of the central cab. There are two compressors driven by 6-hp, 100-volt induction motors, a blast fan rated at 3 hp, and two 6-kw, 3000-100-volt transformers. The latter are independent and either one can run the compressors, blast-fan and secondary starting-gear circuits, so that if the fuse of one transformer is ruptured through any disturbance in the high-tension line, the other transformer is available.

The performance curves in Figs. 6 and 7 show the characteristics of the motors in series and in parallel. Road tests of the locomotives show a development of 2000 hp on a current con-

sumption of 320 amp; the weight of the locomotive with filled sand-boxes and water-resistor being 60.2 tons. This gives a performance of 33.2 hp per ton.

With the Maffei steam locomotives giving 16.2 hp per ton and the Swiss and German electric single-phase locomotives ranging from 12.5 to 18 hp per ton delivered at the draw-bar, the three-phase locomotive seems to have a comfortable margin in its favor. Great haulage capacity per ton of weight is always a desideratum, especially in roads with heavy grades. With the German single-phase locomotives it does not exceed 11 per cent more than the equivalent steam locomotive, but the ratio between steam, single-phase and three-phase locomotives in trainloads hauled per ton of locomotive weight runs 1.9 for the steam, 2.7 for the single-phase, and 5.45 for the three-phase type. As the cost per ton of the electric locomotives is, if anything, in favor of the three-phase type, it is clear that the cost of locomotives per ton haulage capacity of rolling stock is more than twice as great for the single-phase as for the three-phase type.

In the matter of economy, conclusive tests made with these locomotives showed that a return of about 55 per cent of the energy was feasible on the down-grade stretches. Examination of the performance curves shows that in parallel operation an efficiency of 95 per cent is obtained between 3½ tons and 8 tons torque on the wheel rim, and over 90 per cent for loads over 1¼ tons to 3½ tons, and from 8 tons to the limit of the motor. In series the motors show 89 per cent maximum efficiency and over 85 per cent between 2 tons and 10 tons. The latest single-phase motors in locomotive service have a maximum efficiency between 90 and 92 per cent, dropping to 80 per cent with the lower impressed e.m.f.s on starting. These figures alone show that each system has its own best special cases of traffic service, so that no universal rule can be laid down; but without reckoning any return of energy lost in the transformers of the single-phase locomotive, its total energy consumption averages higher for general traffic than the three-phase locomotive.

Possibly the biggest advantage of the single-phase system lies in the absence of the loss in interposed resistance in starting inherent in the three-phase system. Taking the nearest available parallel case, that of a 325-ton train on the Prussian lines against a 412-ton train on the Italian lines, both tested on straight, level track, it is assumed that 10 per cent of the total moving weight will be the tractive effort in bringing the trains up to speed, whence 4 kg per ton will be the average rolling friction. Friction loss in gears of the single-phase and in con-

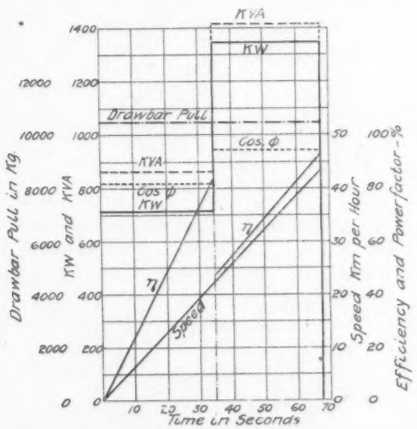


Fig. 8—Power Consumption, Single-phase.

necting-rods of the three-phase are taken at 5 per cent, and the starting arrangements of both types are assumed to be the most efficient that have been devised for their respective types. Then the curves in Figs. 8 and 9 show the energy consumed by the three-phase machine to be 19,200 watt-hours and for the single-phase 13,000 watt-hours in bringing their respective trains up to a speed of 44 km an hour, or for the former 21,350, and for the latter 19,750 volt-amp hours. Reducing both to useful work, the watt-hours per ton for the three-phase induction machine are 54.4, and for the single-phase machine 47.2, or in all 15.2 per cent difference between the two. This takes no account of transformer losses in the equipment, which, of course, would still further increase this difference. In straight, level track, as is noticeable from Figs. 6 and 7,

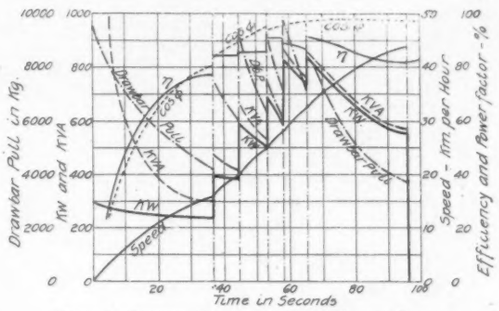


Fig. 9—Power Consumption, Three-phase.

there is no great difference in energy consumption, while under way at full speed; but on alternate up and down-grade for mountain service the advantages inherent in the three-phase system begin to tell heavily in its favor and far outweigh the small losses in starting trains from stations. The returned energy at 45 km and 22½ km per hour speed, at heavy grades such as the 2.6 per cent grade from Biasca to Ariolo on the Gotthard line, reached 55 per cent. On the Giovi line with 3.5 per cent it reaches above 60 per cent. In such cases the energy consumption of the single-phase train without return of energy will rise over 2.6 times as much as the three-phase with this advantage. It is outside the limits of this paper to discuss the effects of this on the power equipment in general, nor indeed the general considerations upon overhead and power-station equipment introduced by the choice of three-phase or single-phase locomotives.

AN IMPEDANCE PARADOX.

By F. M. Denton.

It is a striking fact that the impedance of a circuit consisting of an ohmic resistance in series with either a condenser or an inductance may, under certain conditions, be *reduced* by shunting the condenser or inductance with an ohmic resistance.

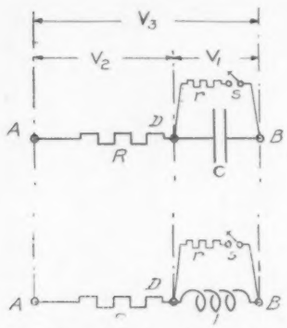
If, in Fig. 1, C represents a 20-mf. condenser, R a 100-ohm non-inductive resistor, and r a non-inductive resistor having a resistance of 250 ohms, then the current produced through R on application of a 60-cycle alternating voltage to the terminals A B will be greater when the switch S is open than when it is closed. The same is also true if C be replaced by an inductor L (Fig. 2) having an inductance of 0.355 henry and of negligible resistance. Fig. 4 is a curve showing the values of the impedance of the circuit AB at 60 cycles, corresponding to various values of the shunt resistance r. This curve is applicable either to Fig. 1 or to Fig. 2, provided the following values be taken: Periodicity of applied voltage, 60 cycles per second; ohmic resistance $R = 100$ ohms; capacity of condenser $C =$ 20 microfarads; inductance of coil $L = 0.355$ henry; resistance of coil L, negligible.

An inspection of the curve of Fig. 4 shows that for all values of the impedance, greater than about 170 ohms, there are two possible values for r. One pair of values is r infinite and r about 99 ohms. Hence, when r is 99 ohms the current passing through R will be the same whether the switch S be open or closed.

A convenient form of vector diagram to represent such a circuit as Fig. 1 or Fig. 2 is shown in Fig. 3, where OV is the

vector of voltage V_1 over DB and VL is the vector of current through C or L (the scales have been so chosen that VL represents also the drop over R due to the current in C or L). When r is infinite the vector of voltage over AB is OL, while VL is the vector of current in R. Lr_1 is the vector of current in r when r is 1000 ohms; Lr_2, Lr_3, etc., are the vectors of current in x corresponding to other values of r, the voltage V_1 being supposed to be constant.

For various values of r the vectors of voltage over AB are Or_1, Or_2, Or_3, etc., while the vectors of current in R are Vr_1, Vr_2, Vr_3, etc. If now the voltage V_2 be supposed constant, while V_1 is allowed to vary, the vectors of current in R will be as follows: VL when r is infinite; VR_1 when r is r_1; VR_2 when r is r_2, etc., where



Figs. 1 and 2—Impedance Circuits.

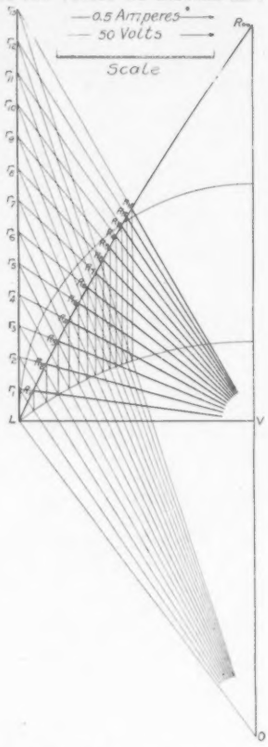


Fig. 3—Vector Impedance Diagram.

$$\frac{VR_n}{Vr_n} = \frac{OL}{Or_n}$$

The construction for obtaining the points R_1, R_2, etc., is obvious; a circle is drawn with center O and radius OL, and from the points of intersection of this circle with Or_1, Or_2, etc., lines are drawn parallel to OV cutting Vr_1, Vr_2, etc., in R_1, R_2, etc. In applying the vector diagram to Fig. 1, in which the condenser is used, angles of *lead* are measured *counter-clockwise*. In order to make the diagram applicable to Fig. 2 angles of lead must be measured *clockwise*.

The actual values used in laying out Fig. 3 were as follows:

$R = 100$ ohms,
$C = 20$ microfarads,
(or $L = 0.355$ henry),
Frequency $= 60$ cycles,
$V_2 = 125$ volts,
$r_1 = 1000$ ohms.
$r_2 = 500$ ohms,
$r_3 = 333.3$ ohms,
$r_4 = 250$ ohms,
$r_n = \frac{1000}{n}$ ohms.

If a smaller value had been given to the ohmic resistance "R" the curve of Fig. 4 would have been less humped, and for very

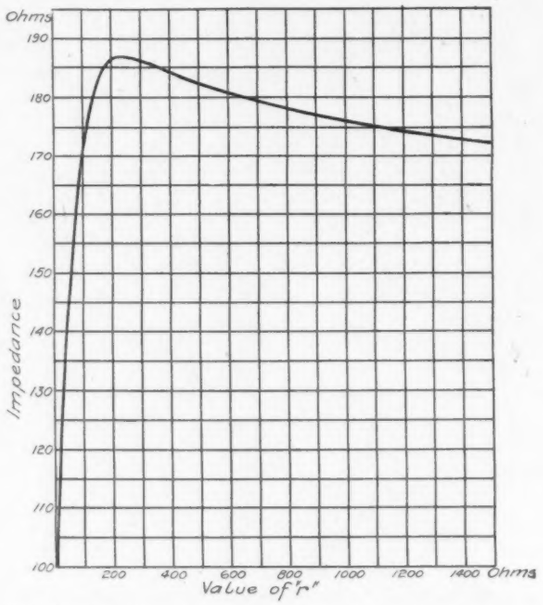


Fig. 4—Variation of Impedance with Shunted Resistance.

small values of "R" the hump would have disappeared entirely. In other words, the phenomenon of increase of impedance due to closing "S" cannot be obtained for very small values of "R."

In the extreme case when $R =$ zero, the circuit AB becomes simply "C" or "L" in parallel with "r," and in such a case it is almost self-evident that the impedance is lowered by closing "S," no matter what be the value of "r." In this case the current that will pass through the system will be the vector sum of the current in "C" or "L," and that in "r," the vectors of which are at right angles; and the sum of two vectors at right angles is evidently greater than either component vector.

Central Station

Management, Policies and Commercial Methods

GROUNDING OF SECONDARIES IN COLORADO.

The practice in Colorado in the grounding of secondaries shows a great advance to-day over its attitude of a year ago. Where only three cities were partially grounded at that time, the circuits in the following cities are either partially or wholly grounded, and those where the grounding of secondaries is only partially completed are proceeding with this form of protection as rapidly as possible: Greeley, Evans, New Windsor, Sterling, Julesburg, Holyoke, Holly, Trinidad, Clovis, New Mexico, Colorado Springs, Denver, Alamosa, Salida, Paonia, Fort Morgan, Golden, Rock Springs, Wyo., and several others. In most of these places the water-pipe type of ground connection has been used exclusively, but in several of the smaller towns which are underlaid at 3 ft. or 4 ft. with water-bearing soil, driven pipes have been used with good result. No case has been reported as yet where lightning has had unusually severe effect due to the grounding of secondaries. The service companies in all of the above cities express themselves as thoroughly satisfied with their grounded secondary systems, and a reduction in the number of electrical fires is looked for.

NEW BUSINESS-GETTING IN LONDON.

The electric lighting system owned by the Borough of St. Marylebone employs a staff of 15 outdoor representatives in its "new-business" department. In the annual report for the year ended March 31, Mr. A. Hugh Seabrook, general manager, states that the object of instituting this department in its present form was to bring electrical service to the notice of every trader and resident in the borough, and to regard every such trader and resident as a prospective consumer.. So far as

existing consumers are concerned, the aim is to remove any cause of dissatisfaction and to bring to the attention of each, by demonstration and otherwise, the many uses other than lighting to which electricity at the present moment can be applied—in brief, to cause electrical service to be considered an indispensable factor in the economy of every business house and private residence, and to bring home that the interests of the consumer and of the central station are identical. He adds that it is no part of the policy to take from contractors work which, without interference, would have been carried out by them. On the contrary, many instances have occurred where, after the preliminary work and expense of advising, estimating and planning for new installations or extensions have been freely done by the staff of the station, the order has been given to a private contractor, notwithstanding that, without much effort or appreciable reduction of profits, the sales department could have filled the order. In other cases the staff has been withdrawn when it was found that a contractor was already dealing effectively with the case in hand.

During the year covered by the report the station sold 10,776,459 kw-hours, 743,002 kw-hours being for public lighting. The increase over the previous year was no less than 1,775,598 kw-hours, which is chiefly ascribed to the more active policy initiated in obtaining new business. The average income per kw-hour during the year, including meter rentals, was 7.6 cents. In 1909 the income per kw-hour was 8.2 cents; in 1908, 8.8 cents; 1907, 9.2 cents, and in 1906, 10.3 cents. In 1907-8 the load factor was 13.6 per cent; in 1908-9, 14.5 per cent, and last year, 15.7 per cent.

NEW PLANT OF THE WORCESTER ELECTRIC LIGHT COMPANY.

The Worcester (Mass.) Electric Light Company has begun the construction of its new steam turbine station at Curtis Pond, in the southern part of the city. The new station, which is being erected according to the plans of Westinghouse, Church, Kerr & Company, will contain an initial installation of three 2500-kva Westinghouse-Parsons turbo-alternators, with space for a fourth unit. The turbines are to be of the double-flow type, running at 3600 r.p.m., and the alternators will deliver three-phase current at 60 cycles to the outgoing lines. The station voltage will be 2400, and five 500,000-circ. mil circuits will be installed to form tie lines between the present plant of the company on Faraday Street, Worcester, and the new station. The Faraday Street station will be utilized as a distributing point upon the completion of the Curtis Pond plant.

The new plant will be a brick and steel structure, 149.3 ft. long by 79 ft. wide, and it will be divided into three sections for boiler room, turbine and switchboard service. The initial steam-generating installation will consist of six 600-hp Stirling boilers, set in three batteries of two each, space being left for a fourth battery when the load requires it. The boilers are to be equipped with superheaters which will increase the steam temperature by about 100 deg. for delivery to the turbine equipment. The boilers are to be set in a row on each side of a central firing aisle 18 ft. in width. The boiler room is to be 76 ft. wide and about 56 ft. in height, with a basement 15 ft. deep in which ash cars will be operated in connection with hoppers carried beneath the floor of the boiler room. Above the boilers is to be a coal pocket of concrete and steel having a holding capacity of about 500 tons. Taylor stokers are to be installed in the boiler room.

The natural draft for the plant will be furnished by two reinforced concrete chimneys, each of which will be 175 ft. high and 8 ft. in inside diameter. Mixed fuel will be burned on the grates. Condensing water will be supplied from Curtis Pond, which the company owns, the area being about 80 acres. Each turbine will be equipped with a barometric condenser, the intake and discharge water being handled by two reinforced concrete conduits carried beneath the basement of the turbine room. The turbine room will be 48 ft. wide and will be carried to a maximum height of 58 ft. from the floor, in order to secure proper lighting and ventilation. The entire room will be served by a 50,000-lb. Maris electric crane equipped with operator's cab and trolleys. The plant will be supplied with coal from a spur track of the Boston & Albany Railroad, delivered to a storage yard outside the power house, from which a modern fuel-handling equipment will deliver the coal to the boiler-room bunker.

At one end of the turbine room a switchboard, bus and feeder regulator section will be built with separate roof, the bus section to be 10.8 ft. high and the regulator section 12.7 ft. high. The company is planning to locate an office section at the new station on the switchboard floor level. A controlling reason for utilizing the Faraday Street station as a distributing center is the company's large investment in underground lines, which at present radiate to all parts of the city from this point. The company's business is growing rapidly and within the past year the connected motor load has been practically doubled. The output of the station is now about 1600 kw.

CENTRAL-STATION SERVICE AT PORTSMOUTH, N. H.

One of the largest areas of electrical supply in Eastern New England is that covered by the system of the Rockingham County Light & Power Company, of Portsmouth, N. H. This organization is one of the subsidiary companies of the New Hampshire Electric Railways, with headquarters in Haverhill, Mass., and its generating equipment has been fully described in these columns (Oct. 11, 1902). While the greater part of the service supplied by the company is mainly electric railway in character, the central-station business has not been neglected, and within the past few years has attained a volume represented by annual gross earnings of about $76,000. The total revenue of the company, including its earnings from the supply of electricity to the trolley lines controlled by the New Hampshire Electric Railways, is about $280,000 per annum. An interesting feature of the company's business is the supply of electricity for the use of summer residents of the territory between Hampton Beach and Kittery Point, including a varied pumping load of a long-hour character at scattered points on the distributing system.

TERRITORY SERVED.

The territory served by the company includes the city of Portsmouth, where the generating plant is located, and the towns or communities of Exeter, Hampton, North Hampton, Hampton Beach, Seabrook Beach, Newcastle, Rye, Newington and Kittery. The Exeter & Hampton Lighting Company supplies the distribution service for Exeter, Hampton, Hampton Beach and Seabrook Beach, and the Rockingham County company delivers energy in bulk to this organization at Hampton, having no direct contact with the local customers at these points. The total delivery of energy to the Exeter & Hampton company is now about 500,000 kw-hours a year. The earnings in Hampton and Exeter were not included in the revenue given above.

The territory supplied with energy for railway service extends as far from Portsmouth as Lowell, Haverhill, Newburyport and Lawrence in Massachusetts, and to Nashua, N. H. Nine substations are in operation and about 200 miles of track. The line potential is 13,200 volts for the railway service, and the most remote point where a substation is located is at Pelham, N. H., about 42 miles distant by transmission line from Portsmouth. Electrical energy from the Portsmouth station is actually delivered on the streets of Nashua, N. H., 50 miles distant. While this distance is moderate in the face of what is accomplished in high-potential transmissions, it is interesting to note that the center of gravity of the company's load is at Amesbury, Mass., about 20 miles from the power station. The line voltage is in general high enough to carry the service, split up as it is, without serious drop. The average loss

between the busbars at Portsmouth, on the high-tension side of the station, and the direct-current busbars at the substations is 20 per cent. The actual loss in the railway transmission lines is not much over 5 per cent. If the load on the Portsmouth plant were concentrated at the ends of the more distant line sections, the present voltage would probably have to be materially increased.

Electrical service in Portsmouth dates back to 1887, under the corporate organization of the Portsmouth Gas, Electric Light & Power Company. This company was purchased in 1901 by the Rockingham organization, the present station being placed in service in 1903. The capacity of the Portsmouth station is now approximately 6000 kw. The plant contains both reciprocating engines and turbines of modern design. The lamp and motor circuits are supplied at a frequency of 60 cycles, and the railway load is handled by 25-cycle energy. A frequency changer is installed in the station to facilitate economical operation and to tie the two portions of the electrical system together in times of emergencies.

DISTRIBUTION CIRCUITS.

Three transmission lines are run out of the station, two going to Hampton and one to Dover, N. H. The Hampton lines are carried west to the different substations supplying the territory outlined above. The Hampton circuits consist of two three-phase No. 00 copper lines about 11.25 miles long, and the Dover line runs to a substation between Dover and Somersworth, which is located about 14 miles northwest of Portsmouth. The latter line consists of a single three-phase circuit of No. 2 copper. In general, the poles of the high-tension lines are of chestnut, with an average length of 35 ft. and the spacing is about 100 ft. Porcelain insulators are used in this service.

The local lamp and motor loads of the company are handled mainly by 2300-volt and 6600-volt lines, the potential depending upon the load and distance of the consumers from the Portsmouth plant. The service in the city is supplied by 2300-volt, 60-cycle, single-phase lines run directly from the station busbars to the consumers' premises. The town of Newcastle is supplied by 2300-volt, single-phase service over a line about 4 miles long. Service to Hampton is furnished over a line 11.25 miles long, and at Rye Beach, 9 miles south of Portsmouth, a transformer substation is in operation for the purposes of local distribution. The potential carried on the Rye Beach and Hampton service is 6600 volts. A three-phase line of this voltage is run through to Hampton, while the line to the Rye Beach substation is a single-phase circuit. On account of the small size of the load in the Rye Beach district in the winter season, the company finds it desirable to cut down the voltage to 2300, which gives good regulation with the size of load carried and enables the line to be operated with less trouble under severe weather conditions.

The company's commercial lighting rate starts with a primary charge of 18 cents per kw-hour, and a secondary rate of 8 cents per kw-hour. If the total consumption reaches 500 kw-hours in any one month, the secondary rate is reduced to 5 cents per kw-hour. The following table shows the arrangements for charging at the primary rate, all energy in excess of that indicated in the table being billed at the secondary rate:

CHARGES AT PRIMARY RATES, PORTSMOUTH TERRITORY.

June, July and August....	1	kw per lamp,	approximately	20	hours	per	lamp
April, May and September.	1.5	"	"	"	30	"	"	"
Feb., March and October..	2	"	"	"	40	"	"	"
Nov., Dec. and January..	2.5	"	"	"	50	"	"	"

The basis of the table is the energy consumed per month per 16-cp lamp connected.

RESIDENCE RATES.

The residence lighting charge at Portsmouth is $1 a month service charge, with a rate of 8 cents a kw-hour in addition. The company recently made a careful study of its residence lighting income and found that under the old rate of about 18 cents a kw-hour the average energy consumption in a residence was 10 kw-hours a month. With the present service charge and 8-cent rate, the consumption now averges 15 kw-hours a month per residence lighted, and the net average rate a kw-hour is approximately 14.6 cents. In the former case the consumer used but two-thirds of the energy which he now takes for his service, and the unit cost was about 3.5 cents higher. Under the present conditions the consumer uses 50 per cent more electricity than he did formerly; his total bill is about 22 per cent larger than before, and yet his unit cost is reduced by the amount indicated. The reduction in the unit rate gives the consumer more for his money than before, and tends to increase the liberality of his uses of electricity on the company's lighting service. The company, on the other hand, suffers no reduction in total income, but makes a gain in the face of a lower unit charge, while the cost of generating, transmitting and delivering the additional energy consumption per residence is proportionally less. This is due to the fact that the fixed charges are but little increased, the fuel consumption is affected but little, and the labor account scarcely altered. The company's practice thus furnishes a good illustration of the response of even that most conservative element in the community—the residence lighting consumer—to a reduction in the kw-hour rate and of the manner in which such a reduction may be made to benefit the company.

RATES FOR MOTOR CIRCUITS.

The motor rates of the company start at 8 cents a kw-hour and run downward in accordance with the consumption. There is at present considerable scattered motor load in Portsmouth and its vicinity, the majority of the loads being carried by alternating-current lines. A small amount of 600-volt direct-current service is in operation in the city of Portsmouth. The company supplies electricity to the famous Hotel Wentworth, in Newcastle, which was the headquarters of the Japanese and Russian plenipotentiaries during the preparation of the treaty of Portsmouth, in 1905, and also furnishes service to the Rockingham Hotel, Portsmouth; Farragut House, Rye Beach, and other hotels of lesser magnitude. On account of the shortness of the season and the distance of the hotel from the generating plant, the company lights the Farragut House mainly off the evening peak, the energy for the service between the hours of 7:30 p. m. and 10 p. m. being supplied by an isolated plant of long standing on the hotel property. A considerable amount of electric pumping by small motors is carried on along the beaches. The motors for this service are mainly of the single-phase type. In a few instances the starting and stopping is automatic, but in general these motors are used in connection with the water supplies of cottages and hotels, and are started and stopped by hand. They vary in size from ½ hp to 1 hp. At Rye Beach a 5-hp motor is installed in a small pumping house which furnishes the water service to a number of grouped cottages between sundown and 10 p. m. Summer residents have a minimum charge of $6 a year.

The company renews carbon lamps free on exchange of burned-out bulbs, and charges a little below cost for tungsten lamps. The consumer pays for the initial installation and can purchase a new 100-watt tungsten lamp for 75 cents, a charge of 50 cents being made for 25-watt and 40-watt lamps. The company supplies energy for window and sign lighting on a flat-rate contract which amounts to about 11 cents a kw-hour, including lamp renewals. The lamps are switched into and out of circuit by means of an out-of-door switch, and the average service is about 19 hours a week. When electricity for electric heating and cooking is supplied on a separate meter the company makes a rate of 5 cents a kw-hour. Electric flatirons are in use in about 50 per cent of the residences using electricity. A 5-cent rate is made for electric vehicle charging, there being a few pleasure vehicles in service in the company's territory.

PUBLIC LIGHTING.

Recently the company secured the contract for lighting Fort Constitution, Newcastle. Thirty-one 80-cp tungsten lamps will

be installed for multiple operation on a 110-volt service, superseding oil lamps. A contract has also been secured for the lighting of the streets of Newcastle, the service to be performed by 27 series tungsten lamps of 60 cp each, operating on a 6.6-amp circuit. These lamps will supersede 25 so-called 60-cp Welsbach gasoline lamps, which were burned on a moonlight schedule at a cost of about $28 a year. The new tungsten service will burn 4000 hours a year, or all night and every night, at a cost to the town of $25.45 a lamp. Portsmouth is lighted by about 85 alternating-current enclosed-arc lamps and 200 series incandescents.

The main offices of the company are located in the heart of the city of Portsmouth, at 10 Pleasant Street, where the quarters of the superintendent and clerical department are established. A feature of the office is a well-selected display of heating apparatus, and a special shelf is installed with upward of a dozen motors mounted upon it. The motors are wired with the necessary switches, starting boxes, etc., to enable them to be run in the presence of prospective customers. The windows are also utilized for varying displays, and the company carries advertisements in the local newspapers. The general policy in the solicitation of new business is to utilize as far as possible the personal touch in local relations, and to depend less upon elaborate systems of campaigning. The population of the company's territory varies widely at different seasons of the year. There are two pronounced peaks on the system, one occurring in the summer and the other in the early winter. The officers of the company are: President, Mr. D. A. Belden; vice-president, Mr. S. W. Emery; treasurer, Mr. S. P. Russell, and superintendent, Mr. J. S. Whitaker.

HARVESTING WITH ELECTRIC VEHICLE.

Rochester, N. Y., is in the center of the nursery business, and is known throughout the state as the "Flower City." The nurseries of Brown Brothers are located about four miles from the business section of the city, and during the shipping season the firm employs a 3.5-ton electric truck for delivering trees and shrubs to the depot; the truck returning loaded with fertilizer and supplies for the nursery. During the harvest season this same truck is utilized in harvesting the hay and, as shown in the accompanying illustration, in harvesting the wheat. The truck, which is of the standard type built by the General Vehicle Company, was sold to the firm by the Rochester Railway & Light Company. The vehicle as shown has 617 bundles of wheat, which after being threshed yielded 45 bushels. The regular two-horse load is 260 bundles. Where the time element in getting the wheat to the thresher, due to the variable conditions of the weather, is so important, one can readily perceive how a progressive company availed itself of modern appliances. The company is, however, no more progressive than the local lighting company, whose work in the electric vehicle and other fields is known throughout the country.

Use of Electric Truck in Harvesting.

DEVELOPING DAY LOAD AT WILMINGTON, OHIO.

Mr. J. C. Martin, of the Wilmington (Ohio) Water & Light Company, gave an interesting account of some work in developing day load at Wilmington in the course of a discussion at the Ohio Electric Light convention in July. Five years ago his company began a day service and proceeded to operate at a great loss. Now, out of 20 possible motor users the company has 17. One of these is a flour mill which the company does not want and has refused to serve. One customer operating a planing mill would not take electric service until after the company had persuaded him to keep an accurate account of all his "power" costs for a certain period. The company then got him as a consumer after having helped him to find a market for the shavings which he previously burned. A livery stable owner was found who was glad to take the shavings, and it developed that there was a market for all the kindling wood the concern could turn out. This customer paid for the motor on the installment plan.

Another customer formerly had a gas engine. When he began electric service he was unusually busy and consequently the central-station management perceived that his electric bills would be considerably higher than the average. To avoid scaring him with these unusually large bills the service was allowed to run a number of months without rendering a bill, as his business did not run so heavy in the following months. When at last a collector was sent with a bill he paid it without comment, but confided to one of his neighbors that he had received his bill, and, although it was a little high, he would not go back to the gas engine if the bill had been double the amount. The advantage to his business in being able to start up work on short notice whenever necessary appealed to him strongly when compared to his experience with the gas engine. Mr. Martin stated his policy to look after customers and take care of them in every way possible when in trouble. He also urged treating employees well so that they will stay by the company when it is

in trouble and work until the trouble is over. He said that he had men who had worked 24 hours continuously when necessary in case of power-plant troubles.

A guessing contest was held in Wilmington to raise funds for a home-coming celebration. The company donated electric stoves and other electric appliances, placing them in a booth on display. The cost of these donations had been returned fourfold in sales of similar appliances since that time.

TUNGSTEN LAMPS AND RATES.

At the convention of the Ohio Electric Light Association in July a discussion on tungsten lamps, central-station earnings and rates was opened by a paper by Mr. E. L. Booth, of the Bellaire Light & Power Company, on "Tungsten Lamps Versus Central-Station Earnings," an abstract of which was given in our issue for Aug. 4.

Mr. M. D. Cooper, of the engineering department of the National Electric Lamp Association, agreed with the author that the effect of the high-efficiency lamp on central-station earnings is largely a question of rates. The straight meter rate is slowly but surely becoming a thing of the past. Changing conditions of load have forced some to the conclusion that central stations have too much fixed expense to make a straight meter rate feasible. He quoted statistics collected by Mr. S. E. Doane for his recent National Electric Light Association paper, which showed that for an average station 14.6 per cent of the total annual cost depends on the number of customers served; 55.1 per cent on the size of the plant, and 30.3 per cent on the output in kw-hours.

The present income could be equaled by a rate made up as follows: Demand charge of from $30 to $40 per year per kilowatt of maximum demand; customer charge of from $12 to $15 per year; output charge from 1.5 cents to 2 cents per kw-hour. The demand charge is computed on the basis of a diversity factor of 1.5. The different classes of loads have different diversity factors and hence the demand charges should be based accordingly. Residence lighting has about as high a diversity factor as any class, in some cases as high as 4. Making due allowance for this high diversity factor it is seen that the demand charge could be made as low as $15 for this class of service. Large commercial installations could be supplied with demand meters. With small light customers this would add to the expense per customer and the demand could be estimated as a certain percentage of the connected load; or, better still, could be based on the floor area to be lighted. In figuring up the area to be charged for only living rooms should be considered, leaving out closets, alcoves, pantries, halls, etc. This method of applying the demand charge would not place any restrictions on the connected load.

Mr. Cooper said that Mr. S. B. Hood, in a paper before the Canadian Electrical Association convention, in advocating a rate of this kind, gave statistics concerning the number of residences, showing that very little error would be introduced by basing the demand charge upon the floor area. As the demands of the individual customer become less with the use of high-efficiency lamps the customers' expense assumes relatively more and more importance. The customer charge of $1 or $1.25 per month would be prohibitive for very small customers. The substitution of cheap current-limiting devices for meters will nearly do away with the meter expense and reading, which constitute a large part of the customer cost. This means the adoption of flat rates for this class of service. These need not be feared on a guaranteed-demand basis with customers with whom a difference between a monthly bill of $1.50 and one of $2 decides the question of electricity or no electricity. These would inevitably use high-efficiency lamps to keep down their demand and would be careful about needless burning if they bought the renewal lamps.

Mr. W. C. Anderson, of Canton, discussed the situation to the effect that, although it might look alarming at first sight, customers once accustomed to better illumination will not go back to a lower degree, which fact has a very important bearing on the effect of the tungsten lamp on revenues. He criticised adversely the present scale of lamp prices and maintained that the manufacturer practically puts a premium on the purchase of the 25-watt lamp as against the 40-watt lamp, by selling the 25-watt lamp at a lower figure, although it costs as much to produce as the 40-watt lamp.

Mr. B. H. Gardner, of Dayton, criticised the rate proposed by Mr. Cooper, and showed that the equipment charge of $1.25 per month plus a customer charge of $1.25 per month would make a monthly bill of $2.70 for a customer using only 10 kw-hours per month at the proposed kw-hour rate of 2 cents. This plan is not feasible. He pointed out that in Detroit a large and profitable residence business is done on a rate system which gives an average return of 6 cents per kw-hour. He failed to see much in favor of the use of the flat-rate limiting devices proposed. At Dayton the cost of meter reading per month is 1.25 cents and of billing 2 cents; interest and depreciation at 10 per cent on the meter is 3.5 cents per month in excess of that for a flat-rate controller, making a total cost of only 6.75 cents per month over the current-limiting device. The cost of testing averages 2 cents per month per meter. With a current controller the consumer cannot use electric flatirons or heating appliances without exceeding the specified demand, and cannot hold parties requiring the use of all of the lamps simultaneously. He also pointed out what he considered the fallacy of a much-talked-of plan for charging a flat rate for low-voltage tungsten lamps for residence lighting. Where this plan is used a separate circuit and a meter are needed if the customer wants an electric iron; hence the investment and customer expense are greater than for the usual meter installation. In the latter case there are two bills to be made out instead of one.

Mr. D. L. Gaskill said that the coming of the drawn-tungsten filament in a low candle-power lamp has done away with any necessity for low-voltage tungsten lamps.

Mr. Cooper said that the drawn-tungsten filament cannot as yet be considered as good as the ordinary filament. He thought that where a residence installation is below 250 watts or 300 watts flat rates are best.

Mr. John Gilmartin, of Toledo, pointed out that in Hartford, where low-voltage flat-rate tungsten residential lighting is practised, the revenue per kilowatt is high, but per customer is low.

TURBINE TROUBLES.

Mr. F. R. Brosius, of the Columbus Railway & Light Company, prepared a paper for the Ohio Electric Light Association convention at Cedar Point, July 26 to 28, on the subject of "Turbine Troubles." The object of this paper was to show some of the minor troubles with which the operating engineer has to contend, most of the troubles related having come before the writer's personal observation with two 500-kw and one 1500-kw turbine. An abstract of this paper appeared in our issue for Aug. 4, page 272.

In the discussion of Mr. Brosius' paper Mr. W. S. Townsend, of East Liverpool, reported having four Westinghouse turbines: one of 1000-kw and three of 500-kw rating. One of these runs six months at a time without a shut down. The cost of repairs has been so far almost negligible. He lays their successful operation to keeping these turbines running without repeated heating and cooling due to shutting down. One of the 500-kw units had its blades badly eroded by the sediment carried through in the steam from the Ohio River water used in the boilers.

Mr. W. C. Anderson, of Canton, reported a little trouble from cutting off the buckets by moisture in the steam, due to boilers foaming. However, he does not think that reciprocating engines operate with as little trouble as many hours per year as do turbines.

Mr. John Gilmartin, of Toledo, brought out the importance of cleaning the ventilating ducts through the turbines, because a restriction of these ducts seriously interferes with the ventilation. In this connection Mr. Culver called attention to the large generating output rating which the turbine affords in a small weight of apparatus which makes necessary rapid conducting away of the heat. Therefore, a small film of dirt has a serious effect on the ability to radiate heat. One member asked a question as to the experience of members with exciters directly connected to turbines. Mr. E. H. Beil, of Youngstown, reported having one 2500-kw set with a directly connected exciter on the turbine.

Mr. W. C. Anderson said that a water-lubricated step bearing is much more likely to give trouble than an oil-lubricated one. In answer to a question why his company had installed a steam engine as a recent additional unit in its station after having already installed a steam turbine, Mr. Anderson explained that because of the steam-heating load his company had to have some exhaust steam for this purpose and there was no economy in installing a turbine for operation on from 2-lb to 10-lb. back pressure.

Mr Culver cited the Hudson Terminal Buildings in New York, which have four sources of electric supply: First, a substation supplied with energy from the New Jersey generating plant of the company; second, a storage battery; third, a breakdown connection with the New York Edison Company, and, fourth, an isolated plant having non-condensing engines. This latter plant was for operation during cool weather when all of the exhaust steam would be used for heating. This was a good illustration of the advantage of the non-condensing engine, where exhaust steam for heating is required; otherwise, under such conditions the steam-engine plant would not have been installed.

ELECTRIC VEHICLES IN OHIO.

Mr. J. T. Kermode, of the Cleveland Electric Illuminating Company, in a paper at the recent Ohio Electric Association convention gave some figures on the progress of electric vehicles in Ohio at the Ohio Electric Light Association convention in July. According to the writer a count of the license tags issued up to April 1, 1910, by the State of Ohio, showed that there were in Cleveland 1006 pleasure and 24 trucking electric vehicles in operation, making a total of 1030. In the whole state there were 1796 vehicles of both classes. Had their use been as extensive in other cities as in Cleveland, in proportion, there would have been in the state approximately 4500 vehicles instead of 1796. In Cleveland the ratio of electric to gasoline and steam cars combined is 1:4. In the whole state the ratio is 1:10. In Cleveland there are 596 private charging stations and 14 public charging stations. It is estimated that the central station furnishes energy for 900 vehicles and isolated plants furnish the remaining 130. There are 408 private mercury-rectifier stations in Cleveland, 188 private motor-generator stations and 8 public charging stations. Of the 596 private stations, 460 are connected with the house lighting meter. Mr. Kermode gave a table showing the average number of hours' daily use of the demand to be 2.6 for the separately metered motor-generator sets and 1.46 for the rectifiers separately metered. He also presented a table showing the total number of kw-hours sold per month, which showed a fairly uniform consumption during the entire year. As there are fewer vehicles in operation during the winter the uniformity is due to the increased energy necessitated by winter road conditions.

In connection with mercury rectifiers he called attention to some features to which consideration should be given in the interest of satisfactory service. The mercury rectifier automatically reduces the rate of flow of current as the battery voltage approaches the rectifier voltage and will eventually open the circuit of its own accord. Good line regulation is essential or else the rectifier will either cut out before the battery has been sufficiently charged or it will overcharge. Usually the battery is charged at night and it is good practice to set the rectifier at a point where it will shut off before the battery is overcharged and, if necessary, complete the charging next morning.

A valuable asset to every private charging plant is a discharge rheostat for the purpose of completely discharging the battery occasionally. This should be thoroughly explained to all owners of electric cars so that they may realize the importance of treating their batteries properly.

Successful operation of electric delivery wagons depends on mechanical conditions, systematic inspection, frequent cleaning, oiling and adjustment of all parts. A slight increase in friction may reduce the work of the wagon by 25 per cent or more. As continuity of service is important it is sometimes advisable to keep delivery wagons in public garages where all-night service is rendered, thus permitting inspection and minor repairs being made without delaying the wagon service during the day.

In delivery service covering a large territory, excellent results have been obtained by the use of the Edison battery and also with the high-output lead battery. The latter has a large number of thin plates which, because of their increased number, give a longer discharge and greater mileage per charge. The maintenance, however, is greater than with the ordinary plates.

In discussing Mr. Kermode's paper, Mr. R. E. Russell, of the General Electric Company, emphasized the point regarding the automatic cutting out of mercury rectifiers. On long feeders, where the voltage is boosted to compensate for heavy peak loads, the voltage is likely to be too high during the latter part of the night when charging is being done, which results in overcharging of the battery. It is a simple matter to arrange a time switch to cut out at a certain time.

Secretary Gaskill said he had met a number of members in advance of the convention who were enthusiastic about the electric vehicle, but none of them had done much in that direction. He said that $7 per month is the average gross revenue per vehicle obtaining in Greenville.

Mr. Kermode, in answer to a question, said that he did not think the ratio of electric to gasoline vehicles is increasing. The average annual revenue at the 5-cent rate as obtained in Cleveland from installations connected on the regular lighting meter is $60 per vehicle per year.

Mr. C. W. Chappelle, of the Electric Storage Battery Company, answering questions as to the desirability of an occasional complete discharge of a battery, said that such a discharge allows the lead oxides on the plates to be more completely re-formed than is possible with a partial discharge. In other words, it gets the inner parts of the active material to working, whereas only the outer layer would work if the battery were kept merely charged all the time. He hesitated to give any rule as to how often a battery should be completely discharged, because conditions vary so greatly. If he owned a battery himself, which was well looked after and used daily, he would have it discharged fully once a month. If it is necessary for a battery to stand idle for six months without being taken down it should be charged occasionally. If possible, however, it was advisable to take down a battery under such circumstances and remove the plates from the electrolyte. In answer to a question as to the system of rates for this kind of business at Cleveland, Mr. Kermode explained that the garages of most private users are connected on the same meter as the lighting service. By this arrangement the customer's consumption for lighting usually exceeds the primary high-rate proportion of the bill so that the battery charging all comes under the secondary low rate at 5 cents per kw-hour. However, many people who live in apartment houses have to keep their vehicles in separate garages, so that separate supply meters are required.

Mr. C. C. Custer asked opinions as to the relative advantages of alternating and direct-current service for charging,

assuming that both services are available. He had advocated direct-current service for his customers in such cases.

Mr. Russell thought that direct current would be best if the battery were one having a large number of cells so that the rheostat losses would be small. Where the battery has a small number of cells necessitating considerable rheostat loss the rectifier is better.

Mr. W. C. Anderson, of Canton, said that his company had considered that because of the high cost of vehicles and the work necessary to sell and look after an electric vehicle, better results in the shape of good revenue-producing business could be obtained for the same effort in other directions. He also told of the case of an electric vehicle customer who recently had his attention called to the fact that his battery needed immediate attention. He was much surprised and said he had been told by the salesman that he would have to do nothing in the way of attention or repairs in two years.

Mr. F. M. Tait said when one considered that the sale of energy for charging electric trucks meant more output without any additional expense and generating apparatus, the business looked very desirable. Selling an electric truck is a question of showing that a ton-mile of haulage can be produced cheaper with it than with horses, which fact can be demonstrated. The electric truck is a dependable apparatus.

Mr. W. R. W. Griffin, of East Liverpool, told of the very aggressive policy of the Rochester Railway & Light Company, with which he was formerly connected. The Rochester company sells electric trucks at the list price and maintains and furnishes electric energy for them for one year free. This move had been very successful.

Wiring and Illumination

FIREPROOF WIRING.

A fire in the power plant of the Pueblo (Col.) Suburban & Traction Company on July 24 is of considerable interest as illustrating the danger of congested wiring of inflammable insulation with wood supports, even though contained in concrete pits. This fire originated in an oil-immersed starter located in a concrete pit, and rapidly spread along the cables, breaking up through the floor at the switchboard at several points where small air spaces had been left about the vertical cables. Fortunately, a number of small transformers exposed by this fire withstood the flames, and no considerable amount of oil was fed to the fire. Machines were shut down as rapidly as possible, and within three minutes firemen were flooding the wire pit with water, temporary lines were run and service was resumed by the crippled plant within a few hours. The management is now installing non-inflammable insulation and supports, and is contemplating the complete isolation of oil-bearing auxiliary and transformers.

CENTENNIAL ILLUMINATION IN BUENOS AIRES.

During the recent Argentine centenary celebration held in Buenos Aires the city was brilliantly illuminated, the special lighting for the 10-day celebration costing $5,000 per hour in United States currency. For this occasion the lighting load was increased from 23,000 kw to 33,000 kw, the increase being carried by the Compañía Transatlantica Alemana de Electricidad, an important German corporation; 200,000 lamps of 10 cp each and 400,000 of 16 cp were installed in the streets and squares, the Plaza de Mayo, where the country's independence was declared, and the new Parque del Centenario was particularly brilliantly illuminated; 40,000 lamps of 16 cp each lighted the port and docks for the Venetian festival on the evening of May 28, when the United States steamship *Chester* and the other foreign men-of-war were lit up, making a brilliant effect; 90,000 lamps of 16 cp each were placed in the grounds of the five Centenary Expositions, where several of the illuminating displays used apparatus from the United States. Practically all the lamps and accessories used in lighting the streets, squares and docks came from the United States, the remainder of the material being supplied by Germany.

COMBINED ARC AND INCANDESCENT ELECTRIC LIGHTING POLES IN VIENNA.

The accompanying illustrations show types of tubular iron poles used by the Vienna municipal central station for street lighting with arc lamps and incandescent lamps. There are in use about 1200 poles with one arc-lamp bracket and about 30

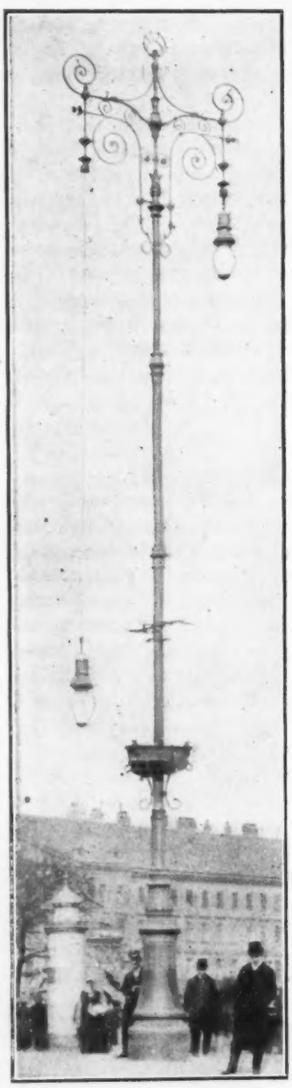


Fig. 1—Pole for Two Arc Lamps.

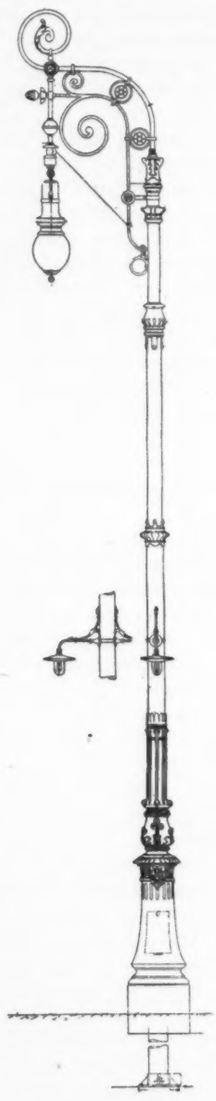


Fig. 2—Pole for One Arc Lamp.

poles with double brackets for two arc lamps. The tubes vary in diameter from 120 mm (4¾ in.) at the top to 180 mm (7 in.) where the incandescent lamps are mounted, and the bases are 930 mm (36.5 in.) in diameter. The incandescent lamps are placed 3.5 m (11.5 ft.) above the sidewalk, while the arc lamps hang about 4 m (13 ft.) above the incandescent lamps.

The arc lamps use pure carbon electrodes and operate five in series from a 220-volt direct-current circuit. The clusters of incandescents, which serve for lighting after midnight, are ordinary 25-cp, 110-volt carbon lamps. Use is made of a few

50 cp, 110-volt metallic-filament lamps for lighting two bridges. Although designed with particular reference to the lighting service, the poles are used also for supporting the span wires of the Vienna municipal railways.

ELECTRICAL ILLUMINATION IN MEXICO CITY.

The electrical illumination of Mexico City in September in honor of the centennial celebration of Mexico's independence will be on a much more elaborate scale than was originally contemplated by the committee having in charge the arrangements. It is now estimated by the Mexico Light & Power Company that nearly 300,000 additional incandescent electric lamps will be used during the entire month. The great Cathedral edifice will be a blaze of light from basement to dome, the plans for its illumination calling for the installation of 16,000 incandescent lamps. More than 8000 lamps will be used to decorate the front of the National Palace. On each of the other public buildings from 2000 to 6000 lamps will be used. Every business house in the city has made arrangements for the elaborate decoration of its exterior with electric lamps, some of them contracting for as many as 8000 of the lamps. It is announced by the committee on arrangements that it has carefully worked out the street scheme of illumination. The downtown business district will be canopied with light. Triumphal arches will be erected at various street intersections. The main arch of independence will be located at the intersection of Plateros Street and the Zocola Plaza, upon which front the Cathedral and National Palace. It will contain 600 incandescent lamps of 10 cp each and 20 12-amp arcs. At the intersection of each cross street on Avenida San Francisco and Avenida Juarez a double arch, each containing 140 lamps, will be erected. These arches will cross each other, and will consist of two lines of 70 lamps each. In the middle of the block two additional arches will be placed, so that in each block there will be stretched six arches. Many novel electrical decorative schemes for business blocks and private residences have been evolved. A display of the Mexican colors in the decorations will form a part of the decoration of the streets and buildings.

WIRING OF NEW HOME OF INSTITUTION OF ELECTRICAL ENGINEERS, LONDON.

A short time ago the Council of the British Institution of Electrical Engineers took over the building of the Royal College of Physicians and Surgeons on the Victoria Embankment, London, and devised plans for reconstructing the interior of the building. This remodeling also included the rewiring of the structure to conform to the new arrangements. The original installation was put in over a quarter of a century ago, and it was quite unsuited for the present purposes of the building. It was decided by the engineers to employ rigid metal conduit throughout, for the mains, and tinned brass tubes for the lamp

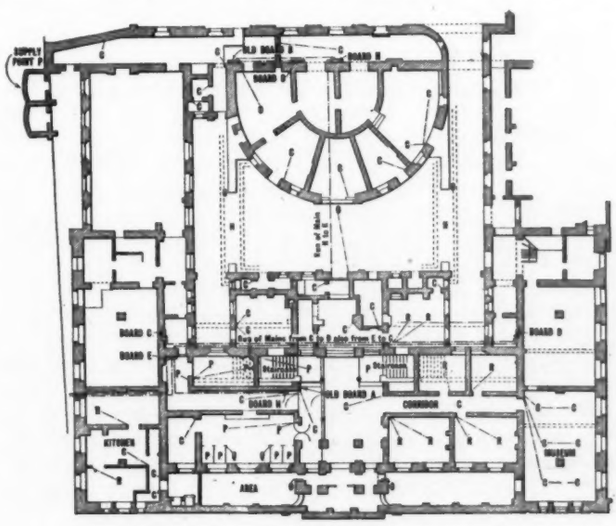


Fig. 1—Plan of Basement, Showing Runs.

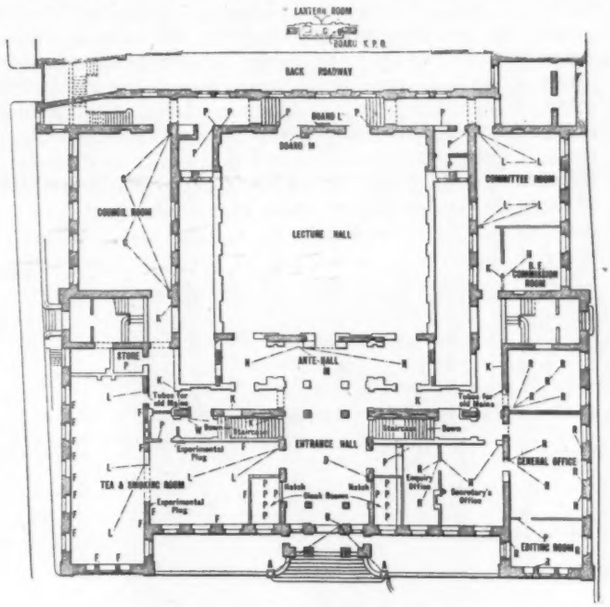


Fig. 2—Plan of Ground Floor.

circuits. The latter is suited for carrying the circuits around the old walls of the building, and with the exception of that in the basement, all of the wiring is concealed.

The system of wiring employing tinned brass tubing is known

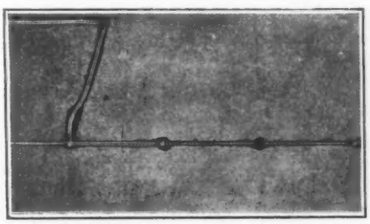


Fig. 3—Example of Ceiling Work.

as the "Kalkos" conduit system, and is coming into use in England as an addition to other wiring systems for branch circuits. The conduit and the fittings follow sudden changes in temperature rapidly, and as all joints are soldered during erection, the

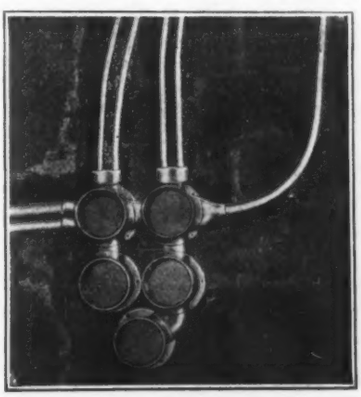


Fig. 4—Close Grouping of Switch Boxes.

system is water-tight. It is somewhat cheaper than rigid metal conduit, and is readily installed in chases in plastered walls.

The supply of energy for the building is obtained from the Savoy Hotel, whose power house immediately adjoins the Institution quarters. The pressure is 100 volts, and the service is in duplicate. The cables enter the building at two distinct points and comprise in each case two pairs of lead-covered mains, coupled up to the service at the point P (Fig. 1) in the basement.

One pair has been disconnected from the existing control board at B and extended by means of a new pair of cables through a 75-amp fused switch to the new board at N. The other pair has been connected into a new board at the point C to supply a portion of the circuits of the Royal College of Physicians and Surgeons, and also into a board at E which controls the circuits in the front part of the building. The board at N controls the circuits to the lantern room, lecture hall and the corridor back of the lecture hall. The board at E controls the

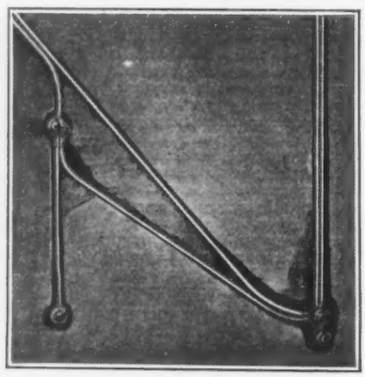


Fig. 5—Grouping of Switch Bracket Boxes.

circuits for the tea and smoking rooms, lecture lantern, basement corridor, first floor, west and east, and two circuits for the cornice lighting in the lecture hall. The layout of the principal circuits in the building is shown in Figs. 1 and 2. In Fig. 1 the letters have the following significance: C = ceiling lamp, H = prismatic glass reflector, and P = plain pendant; in Fig. 2, F = bracket, L = three-lamp electrolier, and R = pendant.

Special circuits have been run for the lecture hall lantern and the lantern room overlooking the lecture hall. In the tea and smoking rooms three experimental wiring points have been provided and these terminate in special cast-iron boxes sunk in the wall. Each box contains two single-pole switch fuses and two heavy terminals with wing nuts to which temporary leads can be quickly attached. Separate motor circuits supply energy to a motor driving a dumb waiter from the basement to the tea room, and to the ventilating outfit.

Figs. 3 to 5 illustrate the manner in which the branch circuits were installed and the application of the Kalkos system of wiring. The standard Kalkos boxes admit of the entry and exit of wires from any point on the side of the box and also through the bottom. The tubes in every case are soldered into special inlet and outlet pieces which are bell-shaped and avoid sharp bends.

NEW TELEPHONE PATENTS.

TELEPHONE ATTACHMENTS.

Much ingenuity has been displayed by inventors of antiseptic apparatus in devising means for attaching them to the transmitter mouthpiece. The peculiar lines of the mouthpiece, upon the one hand, coupled with the requirement that it must not be defaced or permanently changed, on the other, have been responsible for this. A rather clever arrangement is that recently patented by Mr. F. H. Peck, of Galveston. A ring is formed up of sheet metal, being pressed from a flat blank. This has a flange of such size as to slip over the lip of the mouthpiece. The antiseptic membrane is laid against the mouthpiece and the ring is then slipped in place. The back edge of the flange clears the surface of the transmitter mouthpiece because of its taper. The rear edge of the flange is pressed out to receive an internal circular section expanding ring, which, when in position, fills the space between the flange and mouthpiece. A notch is cut in the flange so that one end of the expanding ring will be accessible to facilitate removal.

The invention of Mr. J. A. Perry, of Bidwell, Iowa, consists of a receiver stand with auxiliary sound tubes. The base of the stand has a sound cavity from which the rubber ear tubes extend. The mouthpiece of the receiver covers this cavity, the body of the receiver being held by a clamping prong.

TESTING SET.

Mr. N. Macking, of Wilkes-Barre, Pa., has patented a portable testing set. This includes a magneto, a talking set, a testing battery, a magneto bell, a buzzer and a lamp signal. Various switches and binding post connections are provided to facilitate the manipulation of the circuits and apparatus to give the necessary indications.

TELEPHONE REPEATER.

One of the difficulties with repeaters has been the inertia of the parts and the tendency of the diaphragm to vibrate in its natural vibration periods. It is with a view to decreasing the effect of both these that Mr. L. W. Southgate, of Worcester, Mass., has omitted the diaphragm from his repeater. He uses a light magnetic armature to which the movable electrodes of the transmitting part are connected. The armature is only held in position, against the electrodes, by the pull of the permanent polarizing magnet. It has no hinge or other supports. The power of the permanent magnet may be adjusted to proper sensitiveness and the field is then subjected to the influence of the field of the receiving magnets.

LOADED TRANSMISSION CIRCUIT.

In these days of the frequent use of phantom circuits for long-call business it is evident that if loaded lines be used as the physical circuits, then special coils must be used to load the phantom circuit. This is what Mr. A. W. Ebeling, of Charlottenburg, has done in the system of loading patented by him and assigned to the Siemens & Halske Company. He arranges loading coils non-inductive for the use of the physical circuit as such and inductive when the two limbs are used in parallel as one leg of a phantom. Similarly, the regular loading coils are non-inductive to the phantom. Of course, each circuit is burdened with the ohmic resistance of the coils non-inductive to it.

LETTER TO THE EDITOR.

The Precision of Photometry.

To the Editor of Electrical World:

Sir:—In the editorial on "The Precision of Photometry" in your issue of July 7 you note the results of some experiments which the National Physical Laboratory has been making on the degree of consistency which is obtainable by any one observer comparing together the same lamps on different days. I am in accord with much of what you say, but venture to think that a further examination of the diagram of results which I gave, and to which I take it you refer, will suggest some modification of the conclusions in your article as to the consistency of the results of any one observer obtained on different occasions. You are inclined to the opinion that an observer cannot always come back to lamps previously tested and obtain the same results when other photometric work has intervened. In considering photometry of the highest precision between electric substandards I think we can safely draw conclusions as to the consistency of an observer only from tests on a group of lamps. Observations on a single lamp in a group are liable, as you point out, to vary in some cases by as much as ± 0.5 per cent when measured on different occasions. Such discrepancies do not occur with all observers, but they must, in the main, be put down to the ordinary errors of observation. That is to say, if an observer photometers a lamp twice in the same morning he need not be surprised if his results vary by an appreciable amount. But our experiments go to show that

for any one observer, the mean value obtained for a dozen lamps on one day will agree with the mean value for the same lamps photometered on another day within very narrow limits —even when the color of the lamps is not identical. We have, indeed, found the judgment of different photometrists to remain so uniform that it is possible to apply a small but definite correction for each observer in terms of the average, according to the degree of color difference existing between the lamps under comparison. I do not think it should be difficult to calibrate the observers of one laboratory against those of another with a view to securing international uniformity in a light unit having a whiter tint than those at present in use. This matter is of considerable importance in accurate photometry and is my only excuse for trespassing on your space.

London. CLIFFORD C. PATERSON.
National Physical Laboratory.

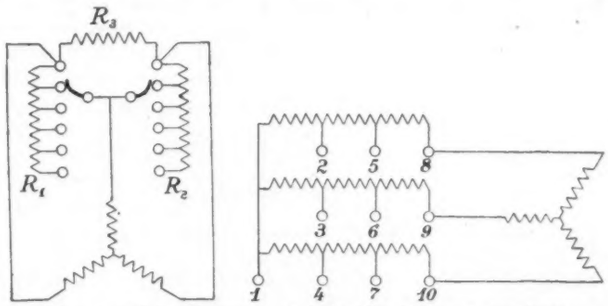
[The above note with reference to the earlier editorial on this subject is most welcome, for it not only confirms some of our doubts but shows the way out of the difficulty. The fact that, as our correspondent says, one can safely draw conclusions as to the consistency of the observer only from tests on a group of lamps, shows very plainly that the errors due to different judgment of balance at different times cannot be considered negligible, but can be in effect eliminated by a sufficient number of observations as regards any one observer. In other words the observer's judgment, while it varies over a very perceptible range will on the whole and with a sufficient number of observations eventually settle to a pretty definite point. However, as our correspondent points out, especially when the lamps compared vary slightly in color, the judgment of one observer as to balance even when his own variations are averaged out of sight may show a consistent small variation from the average results of another observer. It would be extremely interesting to see whether such variations could be traced to slight abnormalities in the color sense, or whether they are purely psychological.—Ed.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Possibilities of Evolution of the Induction Motor.—J. FISCHER-HINNEN.—The author thinks that the induction motor with stator and slip rings and device for short-circuiting the secondary winding and for removing the brushes is in its latest development really a rather complicated piece of machinery. He thinks that in the future motors with rotating resistors will become of greater commercial importance than heretofore. The difficulty which one meets in their construction is found in providing a sufficient number of resistance-steps. One possibility of reducing this difficulty is not to connect the resistors in the usual way in star, but to connect them in delta and to regulate only two phases, as indicated in Fig. 1. In this case only two-thirds of the contacts otherwise necessary are required. Another method is to short-circuit the resistors of the



Figs. 1 and 2—Diagrams of Induction Motor Connections.

three phases not simultaneously, but one after the other. The arrangement is shown in Fig. 2 for three resistors per phase. To start the motor, connection is first made between 2 and the neutral point 1, then between 3 and 1, then 4 and 1, and so on. This arrangement has about the same effect as an eight-step starter of ordinary construction. In view of the advantages of simplicity there are many attempts still being made to improve the ordinary squirrel-cage induction motor. The author discusses first those methods in which the motor is started unloaded and the load is applied only when the motor has accelerated to full speed. Besides the purely mechanical methods, there are electrical methods in which the rotor is equipped with two windings, one of which, with high resistances, is used at starting, while the other is closed only when the motor has been run up to full speed. The method of Goerges (Fig. 3) employs two windings of different numbers of turns which are connected in opposition to each other for starting and are short-circuited afterward. During starting, therefore, only the difference of the ampere-turns of the two windings is employed, while afterward the windings aid each other. The disadvantage is that the change from one connection to the

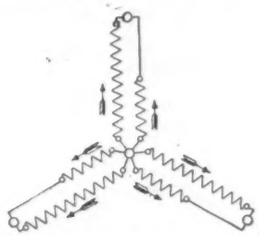


Fig. 3—Induction Motor Connections.

other is too sudden and causes a strong current rush. This disadvantage has been avoided in Boucherot's double motor, which is in no way inferior to the slip-ring motor, and has some other advantages. That it has not become popular is probably due to its expensiveness. To reduce the high starting current, in some cases, the Oerlikon Company has made the short-circuit rings of iron for a double purpose. The first object is to increase the stray field at starting and thus indirectly decrease the starting current. The second object is to produce eddy currents in the ring which consume some power and increase the starting torque. A new type of motor of the Oerlikon Company is shown in Fig. 4, in which, instead of solid rods, use is made of tubes *A* formed of a material having high specific resistance. These are connected together by means of short-circuited rings *B*. Within the tubes *A* there are solid

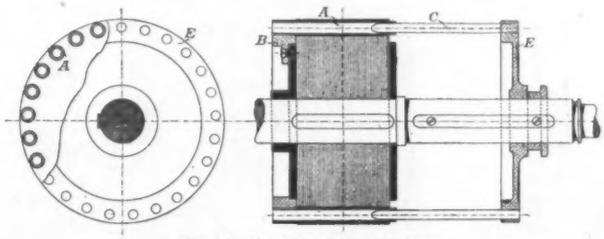


Fig. 4—New Oerlikon Motor.

rods *C* of a material having very low resistance, held together by means of a disk *E* in such a way that they can be displaced and pushed more or less deeply into the tubes *A*. Fig. 4 shows the position for starting when the solid rods *C* are almost removed out of the tubes *A*. With this arrangement the current must pass solely through the tubes *A*, which have a very high resistance. While the motor runs up to full speed the disk

E is pushed further toward the armature so that the hollow spaces within the tubes *A* are filled with the solid rods *C*, which are much better conductors. The resistance is, therefore, gradually diminished and the motor can be brought up to full speed gradually without any excessive current rushes. A motor of this kind was built and tested, together with another motor with ordinary squirrel-cage rotor construction, each motor having a rating of 12 hp, the results being as follows:

	Squirrel Cage	New Mo tor
Normal current, amp.	34	35
Starting current, amp.	190	40 to 48
Starting torque, syn. hp.	13	12.4

According to these tests the new motor seems to be quite as good as the ordinary slip-ring motor, but has the advantage of greater mechanical simplicity.—*Elek. Zeit.*, July 14.

Windings.—G. I. Stadeker.—A continuation of his discussion of the different windings of dynamo-electric machinery. The author deals, first, with threaded-in coils for small direct-current motors, discussing the construction of the core, winding of the coils and method of inserting them, and banding. He then takes up the discussion of open-slotted windings for small direct-current machines.—*Elec. Jour.*, July.

Lamps and Lighting.

Laboratory Arc Lamp.—E. F. Northrup.—An illustrated description of a very simple, cheap, self-regulating arc lamp giving highly actinic light for laboratory work and operating with great steadiness. The construction is shown in Fig. 5. The upper electrode can be either carbon or steel and has a vertical adjustment. The lower electrode, which can be moved vertically, is clamped in an iron tube which floats in a well of mercury. Around the well of mercury is a solenoid of three layers, of 36 turns each, of No. 13 B. & S. gage copper wire. The current enters the upper electrode, goes in series through the two electrodes into the mercury, through the solenoid and out to the negative binding post. The lamp may be operated on a 110-volt circuit with a very small resistance in series. As soon as the current starts, the electrodes are drawn apart by the action of the solenoid on the iron tube in which the lower electrode is held and the arc is maintained with extraordinary steadiness. The best material to use for the well holding the mercury is manganin in the form of a tube. This material is not acted upon by mercury, and it is easy to maintain the well free from leaks. If the upper electrode is of steel and is made positive, the light of the arc has a bluish cast and has very strong actinic properties. It is necessary to use colored glasses when looking at the iron arc. If the two electrodes are made of carbon, the arc is very convenient for use in welding together platinum wires or making other experiments where a high temperature is needed.—*Phys. Rev.*, July.

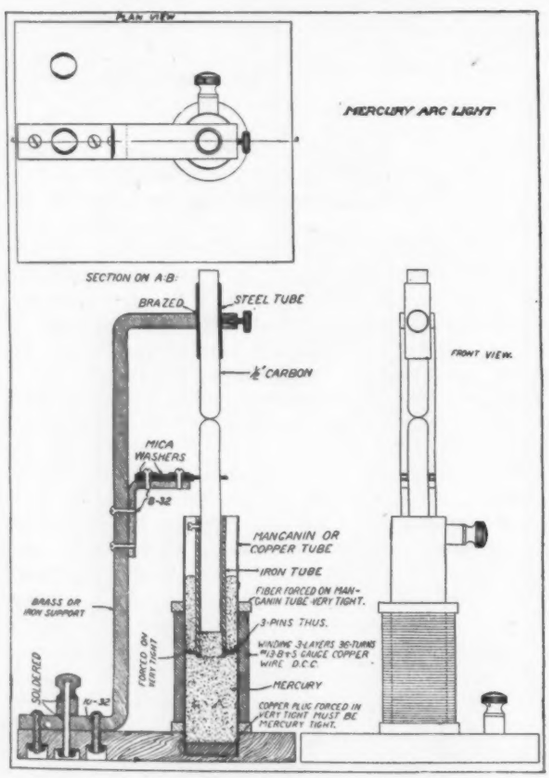


Fig. 5—Diagrams of Laboratory Arc Lamp.

Incandescent Lamps.—A. Bainville.—The conclusion of his review of new incandescent lamps. The author gives results of tests, especially efficiency tests and life of tantalum and tungsten lamps. He considers the single-filament lamp of the French Welsbach Company to represent a great advance in tungsten-lamp construction.—*L'Industrie Elec.*, July 10.

Acetylene Lighting Plant.—A note stating that an acetylene station is to be erected in the city of Platten, in Bohemia. Acetylene gas will be furnished for "56 cents per cubic meter" ($15.85 per 1000 cu. ft.) "for private consumption and 48 cents per cubic meter for public lighting, and 33.6 cents for the operation of motors." Another method of charging is as follows: 8.4 cents per hour for a 60-cp lamp, 5.6 cents per hour for a 40-cp lamp, and 2.8 cents per hour for a 20-cp lamp.—*La Revue Elec.*, July 15.

Train Lighting.—An illustrated description of the Brown-Boveri system of train lighting.—Lond. *Electrician*, July 15.

Generation, Transmission and Distribution.

Cost Curves.—R. Wheeler.—An article on a method of separating the "standing charges" from "running charges" in central-station practice with regard to such items as coal, water, etc. In the case of coal, there is a more or less constant quantity of coal required to keep the plant "ready to supply," that is, "standing charge," and also a more or less constant quantity required to generate each unit, that is, "running charge." The "units generated" and "pound per unit" curve should satisfy the equation $xy = Kx + k$, where x = number of units per week, y = total coal consumed per unit, K = coal required to generate each unit, k = quantity of coal required to keep the plant "ready to supply." A simple way of obtaining the constants of the equation is to plot a rough curve from actual working results, and to correct it where necessary to a smooth curve satisfying the equation. In Fig. 6 the points are taken from the results obtained in practice, and the curve is found to satisfy the equation $xy = 3.6x + 53{,}900$. From this it will be seen that, roughly, 24 tons of coal per week are required to keep the plant "ready to supply," that is, "standing charge," and that 3.6 lb. is the quantity required to generate each "unit," that is, "running charge." The straight line gives the total coal consumption per week in tons, set out from the pound per unit curve. Analogous curves may be plotted for oil, water and similar items.—Lond. *Elec. Rev.*, July 15.

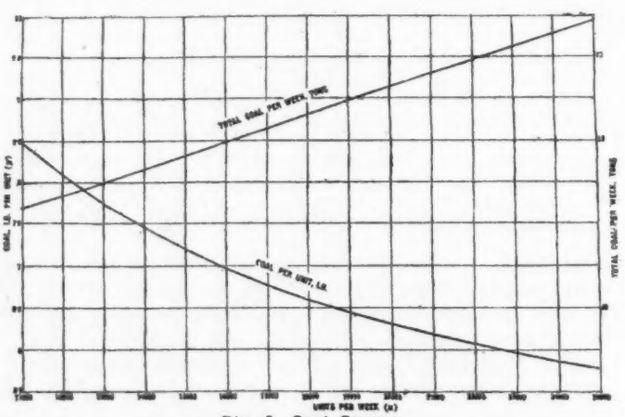


Fig. 6—Cost Curves.

Gas Producers.—J. HOFMANN.—An abstract of a paper read before the International Metallurgical Congress in Düsseldorf on recent progress made in gas producers. It is now possible to utilize very poor fuel, such as is often thrown on the waste heap at the mines, to reduce it to ash or slag. In June, 1910, the Compagnie des Mines Blancy, at Montceau, began to gassify culm-heap residue containing 20 per cent carbon, 15 per cent volatile matter and 65 per cent ash. Coke breeze is mixed with this material, and thus utilized. The complete utilization of the available coal supplies is only possible by the manufacture and use of producer gas, which is, therefore, of the highest economic importance. The production of tar-free producer gas is discussed in another paper by H. Braune and E. Hubendick.—*Met. and Chem. Eng'ing,* August.

Steam Turbines.—E. J. BERG.—A paper, illustrated by numerical calculations, on the effect of superheat, vacuum, initial pressure and feed-water temperature on the water rate and coal consumption of steam turbines.—*Gen. Elec. Rev.,* August.

Condensers.—M. LEBLANC.—The first part of a description and mathematical article on his condensers. In the present installment the author deals with rotary air pumps for condensers. —*La Lumière Elec.,* July 16. The development of the LeBlanc condenser in America is discussed by R. N. Ehrhart in *Elec. Jour.,* July.

Installations, Systems and Appliances.

Central Stations of Belgium.—Statistical tables of the central stations of Belgium. The table covers 93 different stations and the data given as to equipment, rate of charging, etc., refer generally to the end of 1909. No summary of the figures is given. The largest station is in Brussels with a rating of 15,000 kw. The next largest stations are in Morlanwerz with 11,350 kw and in Anvers with 5000 kw. There are 11 stations with rating between 1000 kw and 5000 kw. Six thousand six hundred volts in the highest transmission e.m.f. used on any transmission line. Most of the stations use direct current, but these are, in general, the smaller stations, while the larger stations use almost exclusively three-phase currents. Steam power is used in general, and in most cases reciprocating engines, although in some of the larger stations steam turbines are employed; this is the case in Brussels and Anvers. There were sold in 1909 in Brussels for lighting, 5,488,466 kw-hours and for motor service 1,163,802 kw-hours. The rate of charging in Brussels is for the four months in winter 11 cents per kw-hour for lighting and 4 cents for motor service, and for the rest of the year 9 cents for lighting and 4 cents for motor service. In Morlanwerz there were sold 10,000,000 kw-hours in 1900, the rate for lighting being 10 cents per kw-hour and for industrial purposes 5 cents.—*L'Industrie Elec.,* July 10.

Austrian Central Station.—A note on a new municipal central station in the city of Gablonz, in Bohemia. It will use 260 hp from water and 1820 hp from steam and will maintain a 520-hp storage battery. In the suburbs, where the central station is located, direct current will be distributed at 2×150 volts. For transmission to the city of Gablonz six three-phase currents at 5000 volts are employed. Conversion to direct current is made in a substation.—*Elek. Zeit.,* July 14.

Wires, Wiring and Conduits.

Aluminum Lines.—Comparative figures are given for aluminum and copper as to tensile strength, electric conductivity, specific weight and a calculation is made of the cost of a certain line constructed either of copper or aluminum in which case the copper line is found to be 20 per cent more expensive than the aluminum line.—*L'Industrie Elec.,* July 10.

Crossings.—F. SCHAUER.—An illustrated article on methods of construction of overhead transmission lines at points where they cross a traction system. The article is illustrated by numerous diagrams.—*Elek. Kraft. u. Bahnen,* July 14.

Electrophysics and Magnetism.

Physics and Metaphysics.—H. CREW.—His presidential address to the American Physical Society on the debt of physics to metaphysics. The author deals first with the mechanical postulate, the energy postulate, and the causal postulate, and further shows that metaphysics has rendered distinct service in giving certain helpful preliminary discussions and in pointing out to the experimental inventor the paradox that his greatest strength lies in his confessed limitations.—*Phys. Rev.,* July.

Radio-Activity of Rocks.—A. L. FLETCHER.—An account of determinations of the radium content of a series of volcanic rocks from the Andes of South America. The determinations were made upon a series of rock-specimens taken at various points during the working of the Transandine Tunnel. The striking feature of these results is their poorness in radio-active matter.—*Phil. Mag.,* July.

Electric Waves.—J. W. NICHOLSON.—A second mathematical paper on the bending of electric waves round a large sphere.—*Phil. Mag.,* July.

Electrochemistry and Batteries.

Electric Steel.—B. NEUMANN.—A paper read before the International Metallurgical Congress in Düsseldorf in which the author gave notes on recent progress made in the electric steel furnaces of Héroult, Stassano, Girod, Chaplet, Keller, Levoz, Nathusius, Kjellin, Frick, Hiorth and Ischewsky. The first stage of the development of electric steel making was in the production of high-priced material making sharp competition with the costly crucible process. The electric furnace furnishes much larger quantities of uniform material; it is not dependent on the purity of the material charged; it works cheaper and deoxidizes the metal at least as well as the crucible will; it enables the adjusting of the carbon, silicon and manganese much more accurately, and additions can be made that are impossible to be made in the crucible. Further, high-quality material can be made by refining scrap and other impure materials; this is a field in which the crucible cannot compete. The second stage of the development of electric steel has begun; namely, the use of the electric furnace for producing a mean quality of steel to fill in the gap between ordinary steel and a crucible-quality steel. The electric furnace can be used in combination with the previous steel refining processes to still further refine their product at quite a small cost; there is thus produced a nearly sulphur-and-phosphorus-free product, free from segregation, and of great homogeneity, which is particularly suited for high-class rails, tires, axles and springs. A large quantity of electric steel is being made up into steel castings. The electric furnace is a convenient melting apparatus in foundries which are not large enough to run a Bessemer or a small open-hearth furnace. It will also be useful in malleable-casting foundries.—*Met. and Chem. Eng'ing,* August.

Alloys of Electrolytic Iron and Monel Metal.—C. F. BURGESS AND J. ASTON.—An account of their extended investigations on the properties of alloys of pure electrolytic iron (free from carbon) with nickel or copper or with a nickel-copper alloy in the form of the monel alloy. The results show that for the carbon-free alloys, at least, the combined addition of nickel and copper in the proportions found in commercial monel metal does not result in any deterioration of the good qualities obtained from nickel alone, and that the copper has inherent beneficial qualities of its own. If the same should prove to be true for the addition of monel metal to commercial steels containing carbon, this would represent an important progress for nickel-steel making, since monel metal is cheaper than nickel. The same issue contains an article by G. A. Roush on hardness tests on alloys of nickel and copper from electrolytic iron.—*Met. and Chem. Eng'ing,* August.

Design of Electric Furnaces.—CARL HERING.—An outline of the elementary principles of the designing and proportioning of electric furnaces and of the proper sequence in making the calculations so as to get the best results in the most direct and rational way. The author also points out the ideal conditions which the designer should strive for, even if he can only approach, but never reach them.—*Met. and Chem. Eng'ing,* August.

Units, Measurements and Instruments.

Non-Vibratory Types of Frequency Meters.—C. E. HIATT.—Fleming and Pierce have mentioned the fact that the deflecting

moment acting on the suspended ring of the former's alternating-current galvanometer is a function of the frequency. The present author has used a modification of this instrument (Fig. 7) as a frequency meter. It is a core-type transformer with a secondary free to turn about an axis perpendicular to the plane of the core. The reaction between the field due to the current in this short-circuited secondary and the inducing field gives the

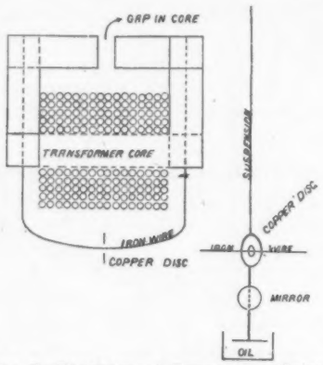


Fig. 7—Diagram of Frequency Meter.

turning moment. The instrument is, however, still essentially a Fleming galvanometer, the Fleming instrument being merely an application of an air-core alternating-current transformer with a short-circuited and movable secondary. The author's modification differs from it merely in the fact that it has an iron core. The results obtained with this instrument show that for lower frequencies it is quite sensitive. It is very easy and cheap to construct, but otherwise it has nothing to recommend it, especially as the indications of the instrument seriously depend upon the variation of wave-form and voltage. The second part of the paper deals with the author's bolometric frequency meter, which depends for its action on the rise in temperature of a thin iron wire subjected to cyclic reversals of magnetic flux. This seems more satisfactory and has a far more extended range. It seems that a single instrument can be made which will measure any frequency from 10 cycles to 1,000,000 cycles per second with a fair degree of accuracy. The instrument and testing equipment are shown diagrammatically in Fig. 8. The iron-work bridge, of which *A, B, C* and *D* are the arms, is enclosed in a tight box of insulating material, which shields it from external temperature changes. Two opposite arms of this bridge are mounted on thin rectangular strips of mica, as shown on the right side of the figure. Each arm consists of an iron wire 0.0513 mm in diameter and about 0.5 m long, strung zigzag fashion through holes in the mica strips. The two rows of holes in the mica are about 4.6 cm apart. As adjacent lengths of wire are separated by the mica sheet, short-

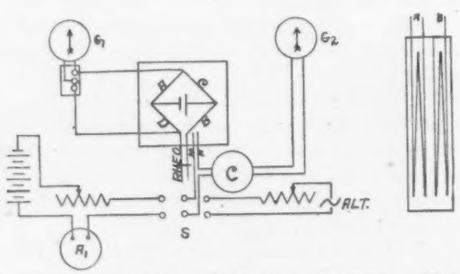


Fig. 8—Connections of Bolometric Frequency Meter.

circuiting of portions of the wire is effectively prevented. The stringing of such fine-springy wire on such a frame is a rather delicate and tedious process. Two frames are made containing the arms *A* and *B* and *C* and *D*, respectively. *C* and *D* are then placed in a solenoid of 1740 turns of double silk-covered copper wire 0.508 mm in diameter and wound on a wooden spool. *A* and *B* are placed in a solenoid containing the same amount of wire and exactly like the first except that it is wound non-inductively. These two solenoids are permanently connected in series and attached to the wires *M* and *N* coming from the switch *S*, which furnishes the exciting current. When alternating current is supplied to these solenoids the bridge arms *C* and *D* get hotter than *A* and *B*, and, due to the high temperature-resistance coefficient of iron, the bridge becomes unbalanced. This is indicated by the mirror galvanometer *G*. The current in the coils is kept constant by means of a resistor of variable resistance and the thermo-comparator *C* used in conjunction with the galvanometer G_2, to form a thermo-ammeter. The most valuable feature of the instrument is its high sensibility. The curves given show that the deflections are proportional to the frequency. Each instrument must be calibrated empirically.—*Phys. Rev.*, July.

Ampere-Hour Meters.—A description of various recent modifications in the construction of ampere-hour meters. A device is first described for compensating for friction. A small positive torque is given to the meter even if there is no consumption of power to be measured, in order to compensate for friction, but without the danger of the meter running without load. The arrangement is shown in Fig. 9, in which *a* is the armature of an ampere-hour meter which is in series with one or several thermo-elements *b*. *a* and *b* are in parallel

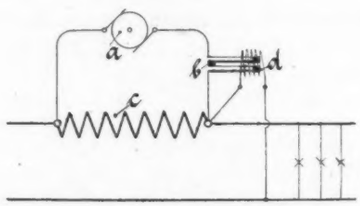


Fig. 9—Ampere-Hour Meter.

with the shunt *c*. One joint of the thermo-element is heated by means of a resistance *d* connected across the mains and is thus kept continually at a higher temperature than the other end of the thermo-element. The connections are so made that the thermo-e.m.f. produced generates a current in the same direction through the armature as the voltage drop in the shunt so that this constant additional torque compensates completely for the friction. The difficulty of this arrangement is the mechanical execution, as it is necessary to reduce the power consumption in the heating wire *d* as much as possible and nevertheless get a sufficient effect. A suitable arrangement is described in detail, iron-constantin or copper-constantin thermo-elements being used. Another improvement of ampere-hour meters described is the construction of the brush holder of two different metals, iron and zinc, so that it changes somewhat its form with varying temperature due to the different temperature coefficients of elongation of the two metals, the brushes being thereby displaced on the commutator. An attachment for indicating the maximum demand is also described.—*Elek. Anz.*, July 10.

Potentiometer Design.—F. Wenner.—An abstract of an American Physical Society paper on a device for the lower decades of a potentiometer to be used in the measurement of

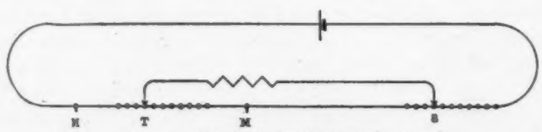


Fig. 10—Principle of Potentiometer.

small e.m.fs. From Fig. 10 (which shows the arrangement of one decade) it will be seen that a part of the circuit, including the potential point *M*, is shunted by a comparatively high resistance. By means of a double dial switch, both branch points between the shunt and the main circuit may be shifted in steps of equal resistance so as to introduce a larger or smaller resistance between *T* and *N* while keeping the resistance shunted constant. The shifting of the switch then produces a change in

the potential difference between M and N equal to the change in the resistance between T and N times the current in the shunt. The device works out well in the design of a low-range two-circuit potentiometer having a low resistance between potential terminals.—*Phys. Rev.*, July.

Instruments.—C. D. HASKINS.—The first part of an article on appliances for electrical measurements. In the present installment the author deals with switchboard instruments and describes their construction, methods of installation and uses. The different types of the switchboard instruments are discussed separately.—*Gen. Elec. Rev.*, August.

Recording Meters.—C. W. DRAKE.—With the aid of examples from the practice of a small wagon works, a saw mill and a paper mill, the author shows how manufacturing operations can be advantageously investigated and controlled by means of recording meters.—*Elec. Jour*, July.

New Apparatus and Appliances

GERMAN EQUIPMENT IN HAVANA.

Some unusual features have been embodied in the 4500-hp generating station recently constructed by the Allgemeine-Elektricitäts Gesellschaft, Berlin, Germany, for supplying electrical energy to the City of Havana. The power house, situated outside the city immediately on the sea, shows some striking constructive features dependent on the extraordinarily favorable climatic conditions in a country where the temperature never falls below 16 deg. C. In fact the boiler-house is completely open on the side turned towards the stoker's stand, the sheet-iron flue being carried above the boiler-house to the chimney. On account of this arrangement the economizer serving to preheat the boiler feed-water has been installed on the roof of the boiler-house. The latter, as well as the engine house, and its accessory rooms, are mainly made of iron structures, while the outward walls are built up of cement blocks formed on the spot. All of the materials, inclusive of the bricks used for the stack, have been imported from Germany.

The boiler-house contains four marine type water-tube boilers designed by Messrs. Babcock and Wilcox of London, each of which has a heating area of 300 sq. m. (3200 sq. ft.) in contact with water, and is fitted with a superheater raising the temperature to 350 deg. C.

The generating plant comprises four 1100-hp, 6000-volt, three-phase generator sets, which are excited from a small storage battery, or a 48-kw motor-generator.

The switchgear, which is shown in Fig. 2, is designed on the transportable switchboard system. The three-phase energy is supplied through a cable system about 50 km (30 miles) in length, laid partly in clay pipes, to a number of oil insulated transformers located in underground cabins of 2160 kw total rating, where the e.m.f. of the high-tension energy is lowered to the working value of 220 volts. The low-tension conductor system which is likewise designed as a cable system then distributes the energy to the various centers of consumption.

Fig. 1—Generating Station with Open-Air Boiler Room.

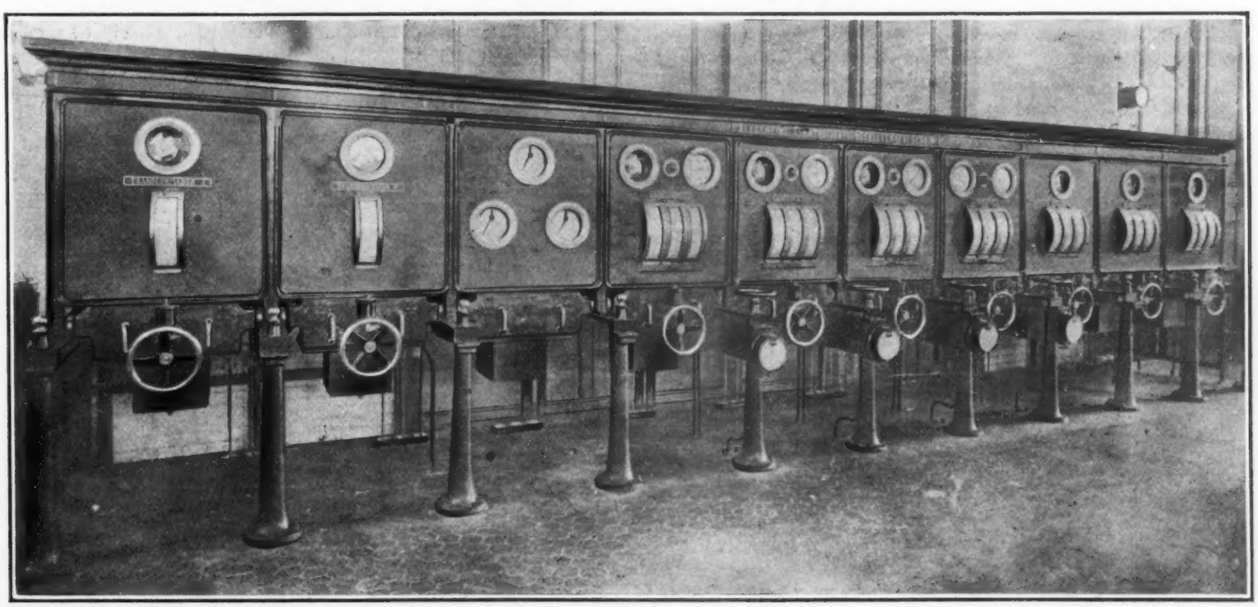


Fig. 2—Switchboard and Switch Gearing.

HIGH-FREQUENCY INDUCTION GENERATORS.

The firm of Hartmann & Braun, Frankfort, Germany, has recently developed a line of high-frequency generators for use in making capacity and inductance measurements, producing pure sounds of any desired intensity, etc. The machines are all of the induction type, and, therefore have no moving electric

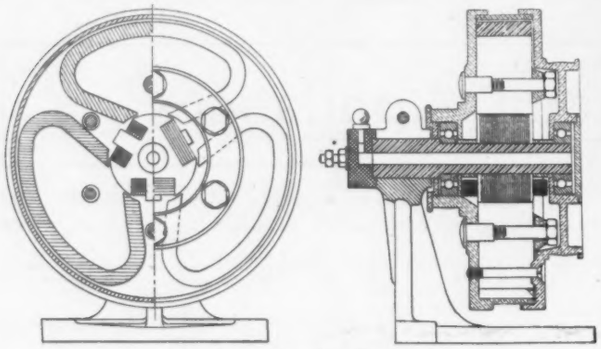


Fig. 1—Tachometer Generator.

contacts. Fig. 1 shows the construction of a six-pole machine, and is typical of the arrangement of the magnetic and electric circuits used in all these machines. It will be noted that there are only half as many armature coils as pairs of field poles. It is claimed that this arrangement of coils is very advantageous. It leaves an un-

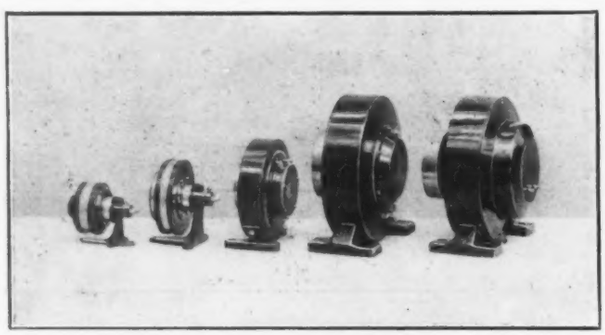


Fig. 2—Tachometer Generators.

broken magnetic path between the coils and tends to preserve uniform and constant distribution of the magnetic flux, and generate a sine wave e.m.f. The armature and bearings are mounted rigidly on the base and the field frame is mounted on ball bearings and finished as a three-step pulley. This type of machine generates a voltage almost exactly in direct proportions to the speed and is, therefore, well adapted to use in connection with voltmeter tachometers. Fig. 2 shows a line of

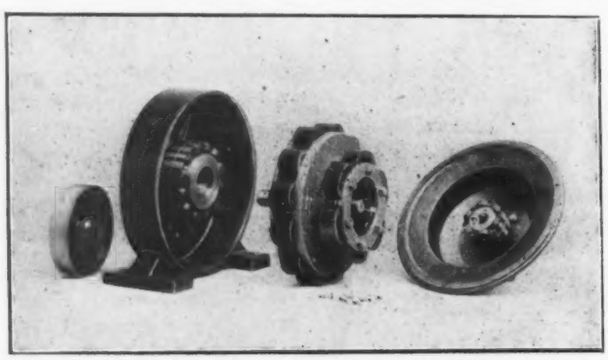


Fig. 3—Composite Frequency Generator.

these machines built for continuous service. In Fig. 3 is shown a composite type with two units in one frame. This machine is especially designed for physicists in studying acoustics. It is used in connection with a telephone receiver for the production of simple and composite sounds of absolute purity.

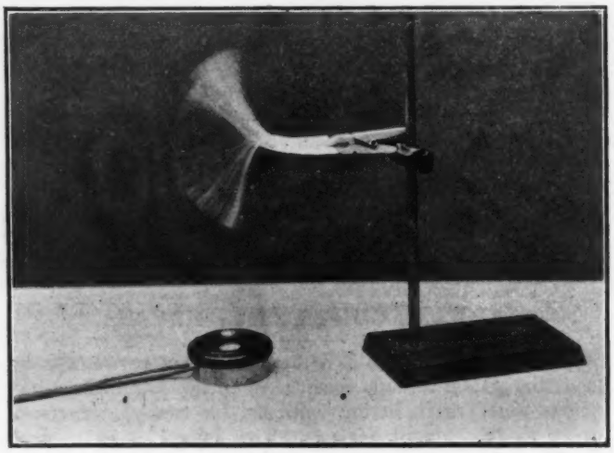


Fig. 4—Sound Vibrations.

Fig. 4 shows an interesting case of resonance. The telephone received is excited by the generator and the sound vibrations are

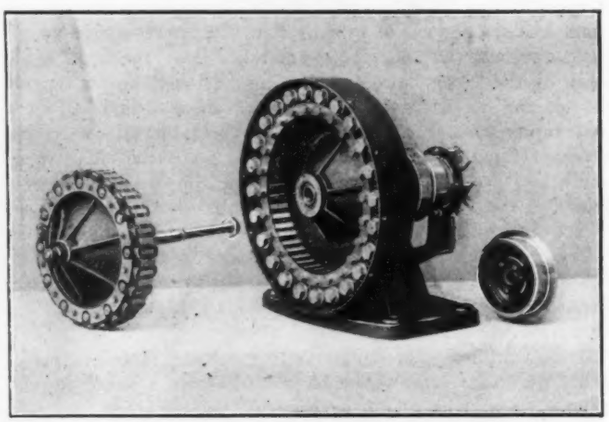


Fig. 5—Double Rotor High-Frequency Generator.

of such intensity and constant frequency that a strip of paper clamped as shown is set into vigorous vibration.

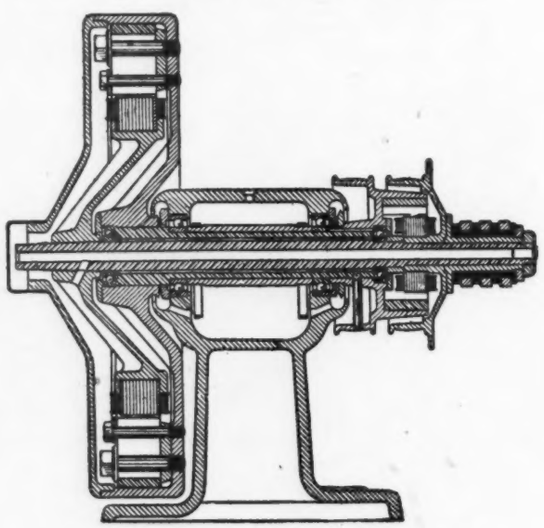


Fig. 6—Section of High-Frequency Generator.

For extremely high frequencies suitable for capacity and inductance measurements machines are built with both the armature and the field poles revolving. Fig. 5 shows a generator of

this type, and Fig. 6 shows the construction. The two parts are driven in opposite directions, thus permitting the attainment of extremely high relative speeds between the two moving members. The spiders that carry the main revolving parts also carry in their opposite end a small generator, which is used

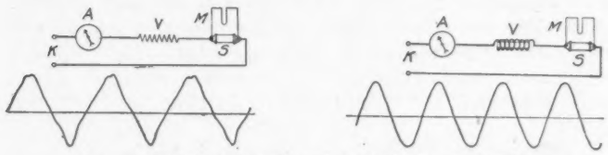


Fig. 7—Effect of Load and Induction on Curves.

in connection with an electric tachometer in order to be able to measure the speed and therewith the frequency of the high-frequency machine.

The diagram at the right of Fig. 7 shows how, by the addition of a small inductance, the e.m.f. wave may be made to approach a sine curve.

WATCH-CASE BATTERY GAGE FOR TELEPHONE WORK.

The battery gage recently developed and placed on the market by the Western Electric Company is a compact instrument for measuring the strength of telephone dry batteries used in connection with the company's transmitters. It is designed for connection to three cells in series, duplicating conditions of the local battery subscribers' set. It contains apparatus for gaging current through two resistances, corresponding to high- and low-resistance transmitter.

The gage is manufactured in the form of a watch-case, as shown in the view herewith. It contains no scale, but is designed merely to indicate the point at which batteries should

Watch-Case Battery Gage.

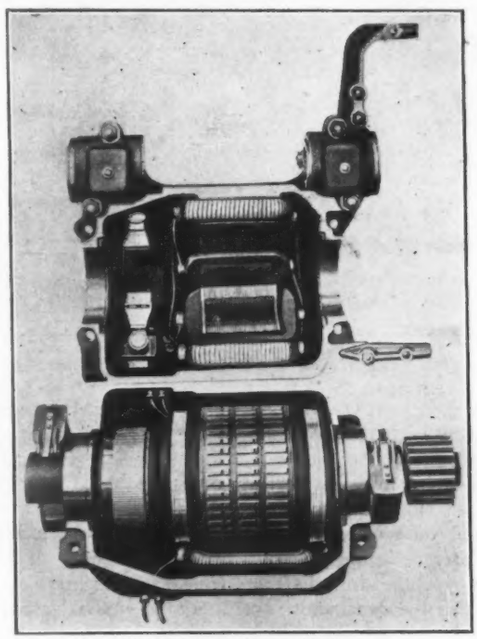
be put out of service. For a high-resistance transmitter a mark above the arc on the face of the gage is used to denote the cut-off point. This means that current from the three cells is being sent through 20 ohms resistance. The cut-off point is 140 milli-amperes, a point which conforms with the best telephone practice. When the stem of the watch-case is depressed 15 ohms is cut out, leaving only 5 ohms of resistance in circuit.

This produces the conditions of the low-resistance transmitter, and the cut-off point, which is indicated below the arc, is 420 milli-amperes.

INTERPOLE RAILWAY MOTOR.

In extending its line of railway motors, the Allis-Chalmers Company has recently placed on the market an interpole motor developed to meet severe conditions of operation, especially on lines which use a potential of 600 volts or over. This motor also has desirable features for use where a lower voltage is employed.

As is seen by the accompanying illustration, the motor is sturdy and strong with ample provision for wearing surface in the bearings. The field frame is constructed of high-quality cast steel and is split horizontally through armature and axle



Interpole Railway Motor.

bearings so that it may be opened downward. The main pole-pieces are of soft steel punchings, securely clamped between malleable-iron end plates, to which they are riveted. The interpole or commutating pole-pieces are of solid steel. The field coils are of the mummified type, insulated and impregnated with a moisture and waterproof compound. The coils are firm and have excellent heat-conducting properties which assist in the cool running of the motor. The bearings are bronze with a thin lining of babbitt and are carefully fitted to the bearing housings.

The armature core is built up of soft-steel laminations carefully annealed and varnished after punching. They are securely clamped between end heads, which also have rims to support the coil ends a uniform distance from the shaft. The laminations are built up on a cast spider, which also carries the commutator so that shaft renewals can be made without disturbing the windings. The coils are wire-wound and insulated in the usual way, but after being pressed in steam-heated molds are cooled under pressure, which gives each the same dimensions. This process makes the coils absolutely interchangeable and greatly reduces the labor whenever it becomes necessary to rewind the armatures.

The motor is rated at 50 hp on 600 volts or 42 hp on 500 volts. These loads can be carried for one hour with a temperature rise not exceeding 75 deg. C. above the surrounding air. It has a continuous carrying capacity of 36 amp at 400 volts. The motors are designed for either double or four-motor equipment, and standard gear ratios are employed.

GASOLINE-ELECTRIC PASSENGER VEHICLE.

The Daimler Motor Company, of London, England, has brought out a gasoline-electric 'bus, seating 34 passengers and combining many interesting features. In this vehicle there is no chassis frame in the ordinary sense, the frame being formed by the bottom or well of the body. This is built up of sheet steel rolled into a deep channel section the whole width of the base of the body. At the points of load application on the springs, cross members shaped and riveted to the steel well are fitted, these adding the necessary stiffening at the points required. To obtain torsional rigidity to meet all winding and

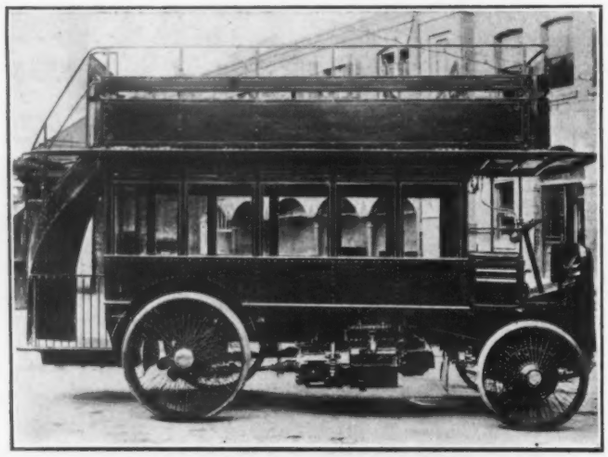


Fig. 1—Gasoline-Electric Passenger Vehicle.

twisting strain on the frame a large rectangular steel tube is fitted in between the two sides of the steel well under driver's seat, and firmly riveted to it. This member also forms the gasoline tank, and has a capacity of 25 gal.

At each side of this sheet-steel frame, and under the top horizontal webs or seat line, are fitted the power units, these on the present 'bus comprising two 12-hp engines of the new Daimler type, the crankshaft and frames of which are extended, and on this the dynamotors are fitted, the whole forming complete and compact self-contained units. Each dynamotor is nominally rated at 3 kw, but has a "give-and-take" capacity of three to four times this rating. The drive from each unit is taken directly from the engine and dynamotor shaft to a worm drive fitted to each wheel, through a tubular cardan-shaft, no differential gear being used. Built up directly on the sheet-steel frame is the body, the framing of which is made entirely of sheet steel; the side posts come straight down from top to bottom, no reduction of width taking place, thus giving a base at bottom the full body width. The side posts carrying the top weight are mounted directly over the spring supports. It will be plainly seen that, besides taking off considerable body weight due to having no "well" as part of the body, the whole superstructure is made much lighter than is possible with the ordinary method. The body and frame, together with the parts, such as steering gear, dashboard, brake levers, etc., mounted on the frame, are slung on the axles at each end with no overhang other than is entailed by the spring lengths. The front axle, consisting of a steel tube, has the steering pivots welded in at each end; these pivots being co-axially in the wheel center, the well-known advantages of central pivot steering are obtained. Front wheel brakes are fitted, these being operated by a foot pedal, and also by a hand lever for standing purposes. The road wheels are mounted on the extremities of a tubular cranked axle tree, and are driven by short live axles coupled direct to the worm wheels on the right- and left-hand sides of the vehicle respectively. The axle tree is so designed that each road wheel and the worm gear by which it is operated are carried directly off the spring bracket—that is, the portion of the axle tree directly supporting the weight of vehicle. Between the wheel and worm casing are fixed the rear springs, and this method of construction enables a maximum spring base to be used, the spring requiring to clear the wheel rims only.

In view of the fact that one of the principal objects in design has been to reduce weight to a mimimum, the employment of wheels of a larger diameter than hitherto used might appear a retrograde step; but by the employment of specially designed suspension wheels, the company has been enabled to use 40-in. diameter wheels on the front axles, and 48-in. diameter wheels on the rear axles; and, besides obtaining the great advantages due to large-wheel diameters, have actually not only reduced the weights of the wheels, but also secured a much larger factor of safety. The unsprung weights have been reduced to a very low figure, that below the rear springs being somewhat under 10 cwt. and that below the front springs about 5 cwt. Special attention is called to the lateral distance between the springs both back and front, the minimum police regulations being exceeded by as much as 9 in. on front axle and 15 in. on the rear axle. By the disposition of the mechanism adopted, the height of the platform inside the body above the ground has been reduced to 27 in., and the ground clearance with the large wheels employed amounts to 15 in. The power units are slunk in the track of the wheels, hence their ground clearance does not enter into consideration; however, a 12-in. clearance is given here. The battery and control board are carried underneath the driver's seat. Four separate methods of braking are possible: (1) By bringing the lever on the steering gear to the strongest field position, when the momentum of the 'bus is absorbed by charging the battery; (2) by a magnetic brake operating on both cardan-shafts actuated by one foot lever which simultaneously declutches the engines; (3) by a foot lever operating the brake on the front wheels; and (4) by a hand lever also actuating the front wheel brakes.

For the control of the 'bus there are two levers placed on the top of the steering wheel—one connected up to the dynamo field controller, this lever entirely controlling the speed, which varies between 3 miles and 14 miles per hour; the other is connected to the two engine throttles. For running in a forward direction, the two dynamotors are in parallel with the battery; the field regulation is controlled by a common rheostat. For reversing, the dynamotors are placed in series, and so an efficient low-speed combination is obtained, giving a high torque and a perfectly balanced reverse drive. The parallel-series position is obtained by a single controller, the operating lever for which is within easy reach of the driver, but is not touched

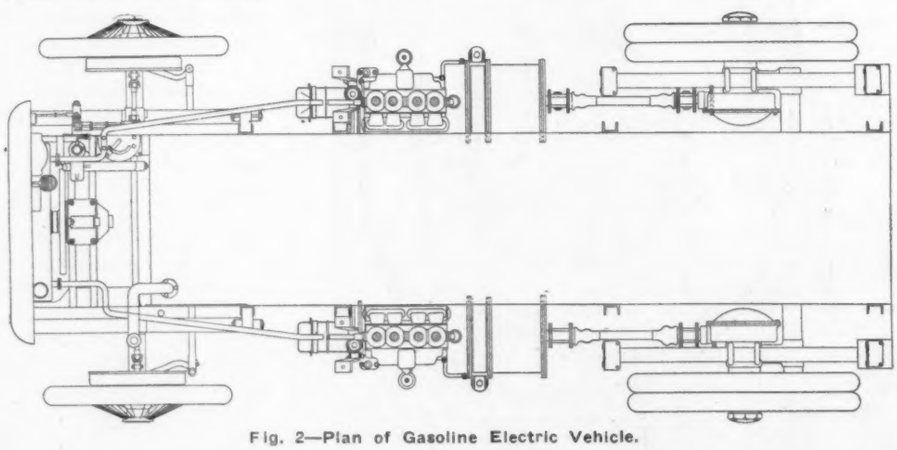


Fig. 2—Plan of Gasoline Electric Vehicle.

by him until change of direction is required. The magnetic brakes and clutches on both power units are in parallel with a single controller operated by a pedal. The radiator, placed in

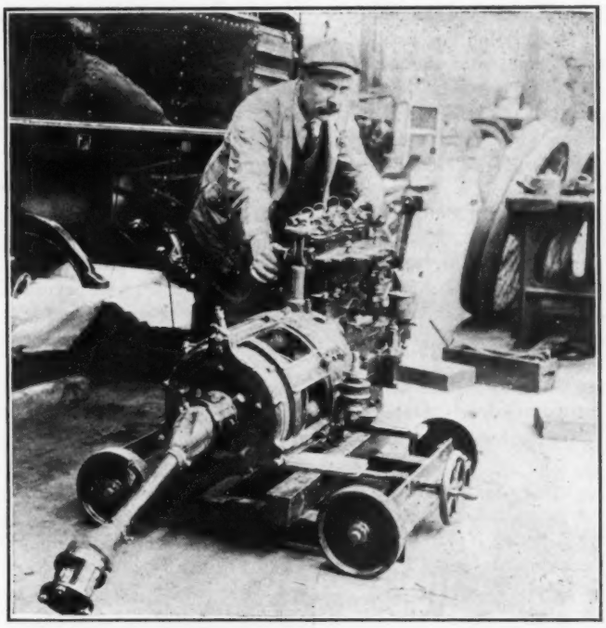


Fig. 3—Engine and Dynamotor.

front of the vehicle, is connected with both engines, the circulation pump serving both units in common. The pump is driven by a small ½-hp electric motor, this also driving a fan of ample capacity arranged in the customary position behind the radiator.

The total unladen weight, including 5 cwt. of accumulators, complete ready for the road, is 3 tons 9 cwt., the regulations allowing 3 tons 10 cwt.

MOTOR-DRIVEN CENTRIFUGAL PUMPS FOR GENERATING STATIONS.

The centrifugal pump is now so well known as to require no general explanation. Its simplicity of action; freedom from water hammer and shock; the absence of valves or running

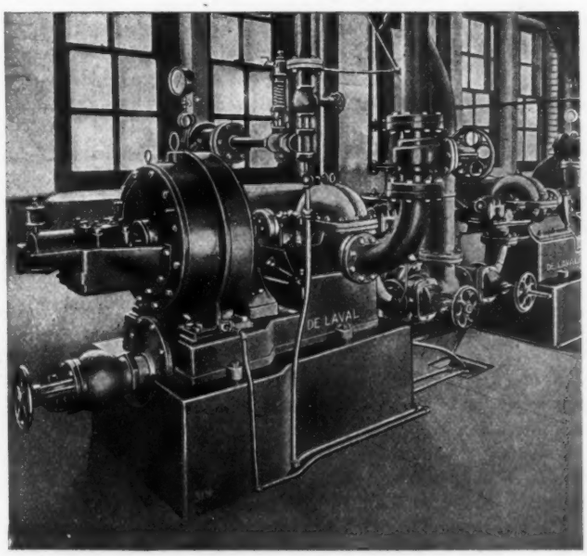


Fig. 1—Motor-Driven Centrifugal Pumps.

parts; its compactness and simplicity; its adaptability to various drives and its general flexibility, enabling it to meet varied conditions of service, have been brought repeatedly to the notice of the engineering public. In the ordinary centrifugal pump the power consumed increases steadily from no delivery up to the maximum. This means that if the head on the discharge of the pump be relieved the amount of energy consumed will be excessive, and perhaps sufficient to overload and burn out the electric motor, or to require the use of an unnecessarily large and expensive motor, as in this type of unit the motor is the more costly part. In the pumps manufactured by the De Laval Steam Turbine Company, Trenton, N. J., the design is such that the horse-power required reaches the maximum at about the delivery corresponding to the maximum efficiency, which delivery is that for which the pump is designed. After this the power taken by the pump becomes less as the flow increases, so that should the head on the pump be diminished, as through breakage of the pipe line or other causes, the brake horse-power will actually decrease, rendering overloading of the motor impossible. This automatic protection of the motor is secured not by the addition of governing apparatus or other contrivances, but by the shaping of the pump passages so that these qualities are retained under all conditions, and at all

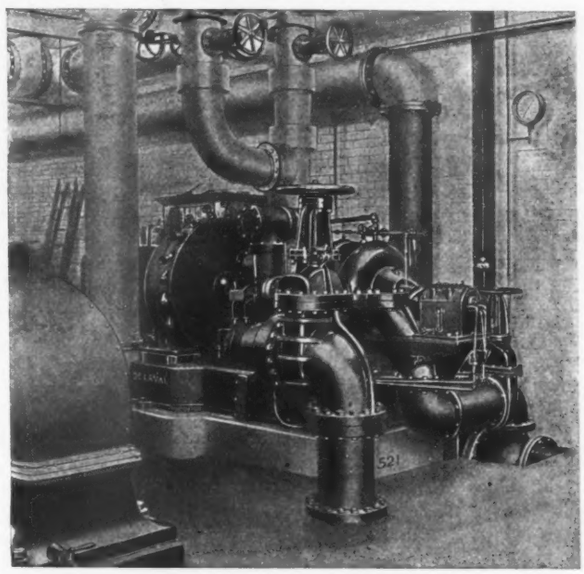


Fig. 2—Motor-Driven Centrifugal Pumps.

times. This property of the De Laval centrifugal pump makes possible the use of smaller and less expensive motors, and permits of the selection of a motor having maximum efficiency at the output coinciding with the demands of the pump under normal operating conditions.

Because of its many admirable mechanical features, the De Laval centrifugal pump is well adapted for pumping water for all purposes in power house operation. Where the pumps are to be directly connected to electric motors it is important that the speed should be adapted to the speed of the motor. In general, high speed motors weigh less and cost less than low speed motors, and the De Laval pump being designed to meet any speed conditions imposed by motors, this feature in connection with its high efficiency and drooping power characteristic renders it particularly adapted to electric drive. When centrifugal circulating pumps are used to supply barometric condensers, the sloping characteristic curve peculiar to the De Laval pump is highly valuable, since a circulating pump must start from no flow against a comparatively high head, without the assistance of vacuum to lift the water, and after the condenser is in operation handle the much larger volume of water demanded by the condenser against a lesser head. For this purpose the pump is therefore designed with a characteristic curve considerably steeper than usual, the curve being proportioned so that the flow of water can be started through the condenser without the aid of the air pump, and so that the pump will subsequently work efficiently when delivering the larger volume at the lower

head. It is claimed that it will also meet a falling vacuum with an increased head preventing the entire dropping of vacuum.

For boiler feed purposes the centrifugal pump has pre-eminent advantages, as it does not endanger the pipe line by vibration and shock, and the entrance of water to the boiler can be regulated without reference to the pump. The De Laval steam turbine driven boiler feed pump can be operated in connection with any standard pump governor to maintain either a fixed pressure or a fixed excess pressure in the feed line, in which case the turbine governor operates only as a maximum speed limit device. Where the highest steam economy is not required as in the case of plants where the exhaust can be used in feed water heaters, the company recommends its gearless turbine driven pumps for their compactness and simplicity. In such units the pump impeller and the steam turbine shafts are connected directly together by a flexible coupling. The pumps can also be fitted with low pressure turbines, or where the steam from other sources is sufficient for heating the feed water the pumps may be driven by electric motors with resulting high economy. These pumps also lend themselves for handling oil, seepage, etc., in large power houses.

ELECTRIC HEARSE.

For the purposes of a self-propelled hearse, there can be no gainsaying the fact that the electric vehicle, with its silence, reliability and dignity of operation, is the only appropriate motive power. What is said to be the first battery-propelled hearse to be constructed has recently been put in commission by a Chicago firm of undertakers, A. L. Bentley & Son, who placed a special order for the vehicle more than twelve months ago. The hearse body is mounted on a regular one-ton Waverley truck chassis, fitted with a single large motor connected to the rear wheels through a double-chain silent drive. The body is carried on three-quarter elliptic springs forward and semi-elliptic springs in the rear.

The battery equipment comprises 42 11 MV Hycap Exide cells, mounted in an underslung battery box, so that the body can be removed from the chassis without interfering with the cells. For efficient operation at low speeds, the controller is arranged to cut the battery into sections, paralleling these to supply energy at diminished voltage to the motors. The steering wheel acts through a worm-and-gear to control the front

Electric Hearse.

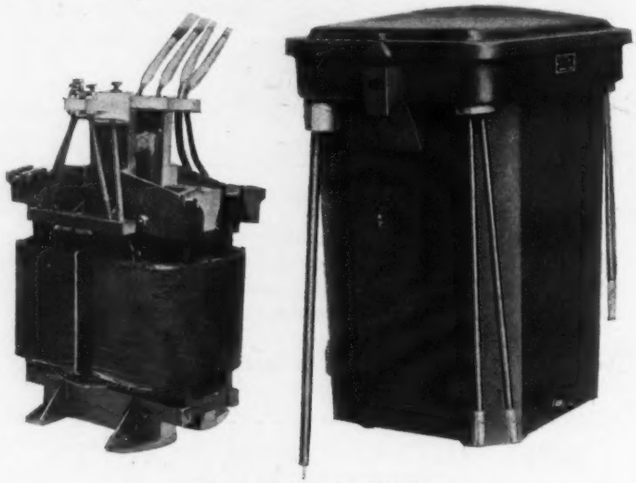
wheels. A head-lamp, tail-lamp and two side lamps are provided. The hearse body, finished inside in mahogany, and having its black exterior ornamented with a chaste design, was built by the James Cunningham & Son Company of Rochester, N. Y. The vehicle complete was furnished by the Waverley Company, Indianapolis, Ind. The design of the mechanical parts and of the body itself has been so carefully planned that the complete hearse appears little heavier than the standard horsedrawn vehicle.

This electric hearse is designed to run 50 miles or more on one charge. While it has never been called upon to make such long trips, it is frequently in continuous service both morning and afternoon for making trips to the outlying Chicago cemeteries, and in a month of practical use has earned the praise of both the undertakers and persons in attendance at the funerals.

NEW TRANSFORMER.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has recently brought out a new outdoor distributing transformer, designed especially for 6600 to 16,500 volts. The case of the transformer, as well as its external appearance, is similar in a general way to that of the 2200-volt transformer of the same company; the same general methods of construction are followed and all of the special features of the latter are embodied in the new transformer.

Elbow-shaped bushings, which are made larger to take care of the higher voltages, hold the leads securely both inside and



Figs. 1 and 2—Transformer.

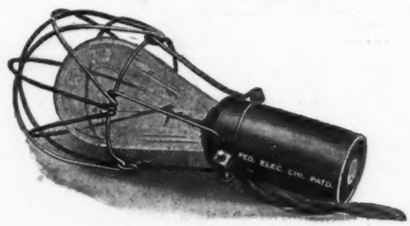
where they issue from the case. An insulating compound is poured into the bushing through a hole in the top to make an absolutely weather-proof joint. An impregnated gasket between the case and cover of the transformer prevents the "breathing" action that is often the cause of the absorbing of moisture into the case under certain conditions of service. Beside the oil plug at the bottom of the case, there is a smaller water-drain plug, through which any slight accumulation of water can be drawn off without appreciably affecting the volume of oil in the case. The contour of the case is very symmetrical and the corners are well rounded, which feature and the impregnated gasket make for an excellent joint between the case and cover.

Both high and low-tension terminal boards are kept under oil, thus precluding the possibility of grounding to the case. Special pains have been taken to prevent the syphoning of oil from the case. From where the low-tension leads come out of the oil, they are bared for several inches and soldered into one solid piece. The high-tension leads from the terminal board are covered with treated cloth tubing, which extends into the high-tension bushing. For a short distance in this bushing, the insulation is entirely removed, and the cable is soldered. Thus, the syphoning of oil from the case is effectively prevented on both the high and low tension leads.

The iron losses, copper losses, regulation, and exciting current are stated to compare favorably with the guarantees made on the 2200-volt type of transformer. The position of the magnetic-circuit gaps is such as to give a minimum exciting current, and the number of gaps is reduced to only two, by means of L plates.

MAGNETIC LAMP SOCKET.

A very convenient device consisting of a cylindrical socket 2¾ in. long and 1½ in. in diameter, fitted with a lamp socket in one end and an electromagnet in the other, is manufactured by the Federal Electric Company, of Chicago, and is illustrated herewith. The magnet is of sufficient strength to hold the socket firmly at any angle on any iron or steel body. It is wound separately from the lamp circuit, so that in the event of



Magnetic Lamp Socket.

accidental breakage, or burning out of the lamp, the energy still operates to hold the socket in place. With this magnetic socket a lamp can be located in the most convenient position, and while it is held firmly as long as it is needed, it can be removed by a slight pull when the user so desires. The socket is furnished wound for use on 110-volt circuits with standard base lamps, and for use on 40-volt and on 6-volt circuits with candelabra-base lamps. The 40-volt type is adapted for use on electric automobiles, while the 6-volt type can be used on sparking batteries of gasoline machines.

POLYPHASE MOTORS IN A WOOD-WORKING SHOP.

The accompanying illustrations show interior views of the wood-working shop of the Murray-Hill Company, New York City. This factory is designed according to the latest improved practice and is constructed throughout of reinforced concrete. It has been laid out so as to obtain good lighting and ventilation and with special reference to economy in the handling of work.

All of the machines in the shop are driven by means of Hawthorn polyphase induction motors, and most of them are equipped with individual drives. Energy is supplied for the

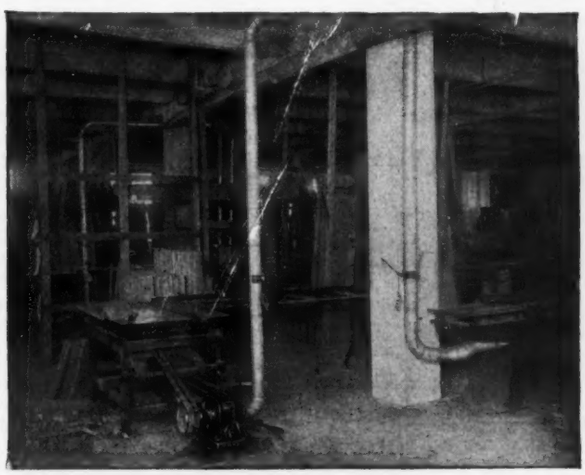


Fig. 1—Sash and Trim Department, Second Floor.

motors and for the lamps by a generating plant equipped with one 150-kw and one 350-kw, three-phase, 60-cycle, Hawthorn alternators directly connected to Williams Monogram vertical engines.

Many of the motors are of the 3-hp rating designed for speeds ranging from 900 r.p.m. to 3600 r.p.m. These motors drive, individually, a turning lathe, 900 r.p.m.; a jig-saw, 1800 r.p.m.; a dove-tailer, 1800 r.p.m.; a spindle-boring machine, 1800 r.p.m.; a key machine, 1800 r.p.m.; a joiner, 3600 r.p.m.; a band saw, 1800 r.p.m.; sash stitcher, 900 r.p.m.; tenoning machine, 1800 r.p.m.; sash dovetailer, 1800 r.p.m.; boring machine, 1800 r.p.m.; and a record joiner, 3600 r.p.m. Motors rated at 3.5-hp drive the following machines: A cut-off saw, 1200 r.p.m.; a dado saw, 1200 r.p.m.; a swing saw, 1200 r.p.m.; a mortise machine, 1200 r.p.m.; a window-sash pocket machine, 1800 r.p.m.; a miter saw, 1200 r.p.m.; a cut-off saw, 1200 r.p.m.; a group of four swing saws, 1200 r.p.m., and a feeder for a

Fig. 2—Sash and Wardrobe Department, Third Floor.

48-in. sander, 1200 r.p.m. Among the 5-hp motors are three on the drums of the 48-in. sander, and one on a broom sander. Five-horsepower motors also drive individually two rip saws, 1200 r.p.m., and two window-sash pulley machines, 1800 r.p.m. There are two 7.5-hp motors, one of which drives a 7-in. molder at 900 r.p.m., and the other of which drives four rip saws at 1800 r.p.m. There are two 10-hp motors driving individually a planer at 720 r.p.m. and a rip saw at 1800 r.p.m.

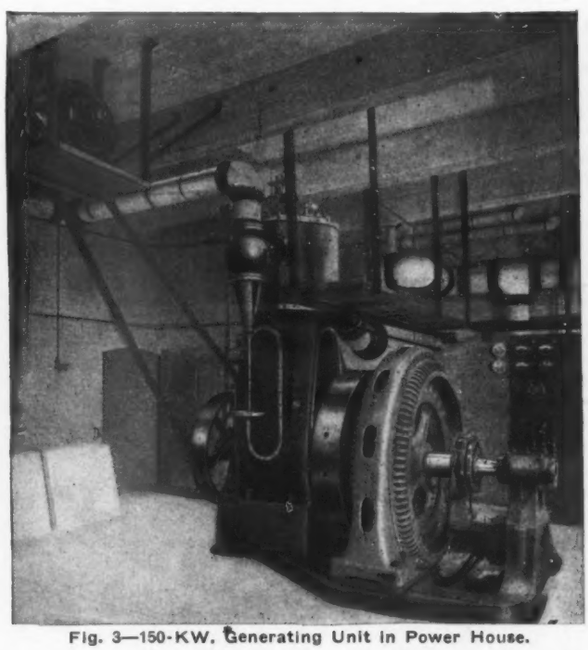


Fig. 3—150-KW. Generating Unit in Power House.

The 15-hp motors installed are used for driving four 10-in. molders, two 9-in. molders and one 26-in. surface planer; these machines are designed for 1200 r.p.m. A single 16-hp, 900-r.p.m. motor has been installed for driving a 12-in. molder. There are two 25-hp, 900-r.p.m. motors, one driving a 24-in. molder and the other a blower. The largest motor in use is a 50-hp machine directly connected to a forge-type blower running at 900 r.p.m.

Industrial and Commercial News.

The Week in Trade.

REPORTS of trade for the past week as received by financial papers indicate that there has been a slight improvement in the general condition of trade throughout the country. In actual business the improvement has not been sufficient to cause any great enthusiasm but there certainly has been a betterment of sentiment. Some of this improvement undoubtedly is due to the fact that much needed rains have fallen in many sections of the West where crops were suffering. The season has now progressed to a point where the crop question is practically settled. The wheat crop is made and the corn crop is so far advanced that only the question of maturing is to be considered. Among the jobbers and wholesalers there is still every evidence of that remarkable conservatism which has marked the buying for the past six months. Many buyers are in the central distributing markets but they are placing orders very sparingly. There is plenty of money in the country and plenty of prosperity, but there seems to be a feeling of fear among consumers and retailers as to what may happen. Without any particular reason for alarm there is a general disposition to go slow. In the industrial world conditions are practically unchanged. There is still curtailment in cotton and woolen manufacture and many of the iron and steel mills are not operating full time. There continues to be, however, considerable business in structural material and quite a number of orders for traction equipment are being received. In fact the traction companies are buying much more liberally than the steam railroads and are doing much more in the way of extensions and development. There has been very little improvement in the matter of collections. They are still slow or only fair. Business failures for the week ended Aug. 4, as reported by *Bradstreets'*, were 166, as against 198 for the previous week, 184 for the same week in 1909, 205 in 1908, 157 in 1907, and 137 in 1906.

The Copper Market.

STIMULATED by the evidence of a curtailment in the output, there was a stronger tone in the copper market last week. The buying, however, was only for immediate requirements, and there seems to be no desire to stock for future consumption. This attitude is attributed to the large surplus on hand, which is considered a guarantee against a runaway market. Cables report a large and increasing foreign consumption, and there are indications of curtailment in production abroad. The production of some of the large mines in this country has been curtailed for some months past and in not a few cases smaller mines have shut down. Better prices for copper may result on this account; but not until the business of the country has shown improvement and railway expenditure is back to normal. Electrolytic was quoted at 12½ to 12⅝ cents and Lake ¼ cent higher. Producers are hopeful, and the fact that consumers are bare of stock should prove a strong factor in maintaining any advance that is made later on. The copper share market shows a better tone since the published interview of Mr. J. D. Ryan, president of Amalgamated Copper, who was one of the leading figures in the recent conferences which were held with a view of arriving at some understanding regarding the question of diminution of copper production. The general opinion expressed is that production is in excess of consumption on an unprecedented scale. It is said that the Calumet and Hecla has established a minimum price of 13 cents for copper and that other leading copper interests look for improvements in the price of the metal. The monthly report of the Copper Producers' Association for July, published Monday, showed that over-production of copper was still in progress last month, although not to so great an extent as earlier in the year. Output exceeded deliveries by 2,254,661 lb. as compared with a similar excess in June of 7,961,000 lb. and in May of 18,441,817 lb. An excess of at least 10,000,000 lb. had been looked for, but the returns showed that output had been curtailed nearly 9,000,000 lb. last month, while an increase in domestic deliveries had partly offset a falling off in exports. Following are the July returns compared with those of June and with July last year, figures representing pounds:

Stocks	168,386,017	160,425,973	122,596,607
Production	118,370,003	127,219,188	118,277,603
Total	286,756,020	287,645,161	240,874,219
Domestic deliveries	56,708,175	53,363,196	75,520,083
Exports	59,407,167	65,895,948	75,018,974
Total deliveries	116,115,342	119,259,144	150,539,057
Stocks remaining	170,640,678	168,386,017	122,596,607

Although no definite statements from the leading copper interests have been made, the general opinion is that the output will be materially reduced, and if this is carried out on a fairly large scale, the present surplus will be quickly reduced and the immediate effect would be to raise the selling price of the metal. This feature is the dominating influence in the share market. Lake copper advanced easily on good buying; but it has still a long way to go before it again reaches its high mark for the current year. Daily call on the Metal Exchange August 8 quoted standard copper as per the accompanying table.

STANDARD COPPER.

	Bid.	Asked.	Settling price.
Spot	12.10	12.30	.....
August	12.15	12.25	12.20
September	12.17½	12.20	12.20
October	12.20	12.25	12.22½
November	12.20	12.25	12.22½

The London market August 8 was as follows:

	Highest. £ s d	Lowest. £ s d
Copper, spot	55 1 3	55 0 0
Copper, futures	55 16 3	55 15 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

Industrial and Commercial Notes.

General Electric Sales.—The contract for the four 2000-kw rotary converters required by the New York Central Railroad Company for its new substation at Irvington, and the substation at Glenwood, which were referred to in our issue of Aug. 4, has been placed with the General Electric Company. This apparatus will be installed and be ready for operation by next Spring.

Empire District Electric Company.—The 20,000-hp steam station of the Empire District Electric Company, at Joplin, Mo., is practically completed and ready for operation. The work of constructing this station occupied less than six months, and with its completion the Empire District Company will be able to serve the entire mining section of Joplin and the adjacent territory.

Electric Furnaces for Noble Electric Steel Company.—Taking advantage of the shut-down caused by the inability of the Northern California Power Company to furnish the necessary energy to operate its smelter owing to drought, the Noble Electric Steel Company will erect five more furnaces at a cost of $30,000. The electric process smelter of this company is located at Heroult, Cal.

American Gas & Electric Company.—At a recent meeting of the American Gas & Electric Company, New York City, the following officers were elected: President, Mr. R. E. Breed, succeeding Mr. H. L. Doherty; vice-presidents, Messrs. George N. Tidd and A. M. Young; secretary-treasurer, Mr. F. B. Ball; assistant secretary, Mr. F. P. Hunter; assistant treasurer, Mr. A. E. Smith. The company has sold to the United Gas Improvement Company of Philadelphia, the Conshohocken Electric Light Company of Conshohocken, Pa., and has acquired the Household Electric Light, Heat & Power Company of Jermyn, Pa.; the Hartford City Lighting Company, Hartford City, Ind.; the Jonesboro Light & Water Company, Jonesboro, Ind.; Dunkirk Lighting Company, Dunkirk, Ind., and the Redkey Lighting Plant of Redkey, Ind.

I. P. Frink.—The old firm of I. P. Frink, which has been manufacturing reflectors, and installing lighting plants for many years, will move from its present location, 551 Pearl street, which it has occupied for fifty-three years, some time in September, to a new factory, 239 Tenth avenue, at the northeast corner of Twenty-fourth street. In the new location the firm will occupy an entire five-story building which it has recently purchased. The building is being renovated and made over, and when it is occupied will be as complete a manufacturing establishment as there is in the city. George F. Spencer, manager of I. P. Frink, says that business in the line of that firm has been very good within the past two months Among the recent installations which are worthy of note are those of George W. Benjamin's show windows at Twenty-fourth street and Broadway, New York; the First National Bank of Denver, one of the largest banks in Colorado; the Higbee Drygoods Company of Cleveland; Elliott-Taylor-Woolfenden Company of Detroit; the Old Colony Trust Company of Boston; the New England National Bank of Kansas City, and the new Methodist Church of Gloversville, N. Y. The last-mentioned installation is particularly interesting from the fact that it is one of the first instances in which a church has adopted the concealed lighting system. In addition to those mentioned, the Frink firm has done a considerable amount of work for libraries, schools and other institutions where desk lighting and case lighting are demanded.

Gas & Electric Securities Company.—Henry L. Doherty & Company have completed arrangements for a holding company which, it is promised, will acquire a number of attractive properties and will offer to exchange stock of the holding company for the stocks of the Denver Gas & Electric Company, Empire District Electric Company, of Joplin, Mo., and the Lincoln (Neb.) Gas & Electric Light Company. The new company will have a capitalization of $1,000,000, 7 per cent cumulative preferred stock and $1,000,000 common stock. Doherty & Company announce that they will act as bankers and syndicate managers, and will receive their compensation in the form of a block of common stock of the holding company. They announce that they will turn over this common stock to the treasury of the Gas & Electric Securities Company, and will also assign a contract which they have with the Spokane Gas & Fuel Company for a stock bonus. These gratuities will be used as a bonus with the sale of the preferred stock The right of subscription will be offered to the public for the preferred stock with a bonus of 40 per cent of common stock, or, in other words, 100 par value of preferred stock and 40 par value of common stock will be sold for $100 cash. This company will issue no bonds, and is in no sense a holding company. It simply holds the stocks owned by Doherty & Company and those associated with that firm in their many business ventures.

Railroad Power Plant at Concord, N. H.—The Boston & Maine Railroad has contracted with the Stone & Webster Engineering Corporation, of Boston, for the design and construction of a 1200-kw hydroelectric plant at Franklin, N. H. Double transmission lines along the right of way of the railroad will carry the energy at 22,000 volts to three substations. Electricity will be used in the railroad shops and for lighting the yards and stations. Electrical energy will also be supplied to the Concord & Manchester branch, and to the Concord Street Railway and to Contocook Park. Additional converting apparatus rated at 300 kw, together with step-down transformers and control switches for a 2300-volt lighting system, will be installed at the South End substation. Converter, transformer and switch equipment, rated at 300 kw, and now mounted in a portable substation at West Concord, will be removed and erected in the engine room of the steam-generating station. A new substation, known as Hookset Substation, with an output of 600 kw, will be erected to supply the Manchester branch. New step-down transformers of 500-kw rating will be installed in the engine rooms of the shops, and improvements will also be made in the West Concord steam plant, including new boilers and a 200-kw generator.

Second Avenue to Electrify.—The Public Service Commission has authorized the Second Avenue Railroad Company, George W. Lynch, receiver, to electrify that portion of its lines in Worth street from Chatham Square to Broadway. The lines have not been in use for a number of years. The electrification of these lines had been authorized by the old State Board of Railroad Commissioners in 1898 when the electrification of the main line was approved, but the management of the Metropolitan Street Railway Company, which then controlled the Second Avenue, preferred to send the cars down Park Row to the Post Office. After the roads were put in the hands of separate receivers, the Second Avenue cars were not permitted to run on the Metropolitan lines, and consequently the Second Avenue Company had no downtown terminal. The new line will be double-tracked from Chatham Square to Lafayette street, but will only be single-track from there to Broadway, owing to the large amount of trucking in that locality. The commission authorizes this change on condition that the company abandon various other lines of track which have long been unused, and the receiver has informally agreed to these terms.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Fairfield, Ia.; Fillmore, N. Y.; Cheyenne, Wyo.; Fort Scott, Kan.; Pueblo, Col.; Superior, Neb.; Houghton, Mich.; Hudson, Ohio; South St. Paul, Minn.; Boca, Cal.; Enosburg Falls, Vt.; Sac City, Ia.; Concord, Mass.; Pennsburg, Pa.; Bridgeport, Neb.; Toledo, Ohio; Dalton, Ga.; Kansas City, Mo.; Racine, Wis.; Monticello, Ga.; Warren, Ind.; Pulaski, Tenn.; Opelika, Ala.; Crandon, Wis.; Sanford, Fla.; Colorado, Tex.; Helena, Ark.; Charleston, S. C.; Crosby, Minn.; Jacksonville, Ill.; Montgomery, Ala.; Grand Rapids, Mich.; Fort Totten, N. D.; South Norwalk, Conn.; Ellensburg, Wash.; Falls City, Ore.; East Point, Ga.; Youngstown, Ohio; Thibodaux, La.; Logansport, Ind.; Jackson, Ohio; Athens, Ala.; Pryor Creek, Okla., and Lakefield, Minn.

Mexican Electric and Irrigation Plant.—The preliminary work for the construction of a large dam across the Conchos River, about 20 miles from Santa Rosalia, has been commenced by Messrs. S. Pearson & Son, Ltd., of Mexico City, for the Mexican Northern Power Company. A new town, La Boquilla, is springing up near the dam site, and although the rainy season has interfered with the progress of the work, the contractors are assembling large quantities of material upon the ground preliminary to rushing the work as soon as the dry season sets in. The dam will impound water enough to irrigate about 200,000 acres of land in the valley of the river. The cost of the work is estimated at $7,000,000, and the main line of the Mexican Central Railway is now connected with the works of the power company by a branch line. The company has franchises for lighting numerous cities, and the dam is expected to be complete by the fall.

Decision in Montgomery (Ala.) Muddle.—Judge Thomas G. Jones, of the Federal Court of Alabama, has held that the stock of the Citizens Light & Power Company, of Montgomery, must be delivered to the H. L. Doherty interests. This is the action in which certain of the Citizens company stockholders were up for contempt for making sale of their stock after the Doherty interests had secured a federal injunction based on a prior contract. The contempt proceedings were dismissed on the ground that actual personal knowledge of the injunction had not been sufficiently shown. The court handed down a decree which will protect the Doherty interests in the property until the final trial of the case Full details of the controversy between Doherty and the leading stockholders of the Citizens company were published in the ELECTRICAL WORLD of June 23, 30 and July 7.

United Gas & Electric Company.—The pipe lines of the Richmond Natural Gas Company, of Richmond, Ind., have been purchased by the United Gas & Electric Company from Mr. C. W. Hooven, of Andersonville, Ind., who purchased all the securities of the Natural Gas Company on July 27. The Natural Gas Company owns the Richmond Light, Heat & Power Company, which furnishes artificial gas and electricity in Richmond. Some of the pipe lines acquired will be used by this company, and others will probably be taken up. The Natural Gas Company will go out of existence on Sept. 1, when it will stop furnishing gas to its subscribers, due to the failure of the natural gas in Indiana. Within the last few years the company has had to curtail its service greatly because of this fact. The franchise does not allow it to manufacture gas.

Montgomery (Ala.) Water Pumping Contract.—The Montgomery Light & Water Power Company, of Montgomery, Ala., which is operated by H. L. Doherty & Company, has been awarded the contract by the city of Montgomery for pumping

all of the water at the Public Water Works by electrical energy. Heretofore this pumping has been done by steam, but now the city of Montgomery will install a new equipment and the Montgomery Light & Water Power Company will furnish the necessary energy for its operation. It is estimated that the electric drive for this work will save the city in the neighborhood of $10,000 a year for the cost of coal. The hydroelectric plant owned by the company now is furnishing about 6000 hp, but it is claimed by Doherty & Company that with a very slight additional expense the power can be increased to 9000 hp.

Financial.

The Week in Wall Street.

TOWARD the close of the week the Wall Street market showed a distinct tendency on the part of the larger financial interests to view both securities markets and the financial situation generally with something akin to cheerfulness. Stocks gained ground last week on the average; but business did not show much material gain over the final figures of the preceding week. The influence of a number of unsettled elements in the situation continued to exert from time to time a feeling of disquietude, and this was reflected in the quieter and narrower movements of securities in the stock market. Aggressive speculation has been checked by the willingness of banking interests to render some support by the extension of relief to weak holders of large blocks of securities. Further contraction of trading in the price movements is anticipated. Using the trend of the country's iron and steel trade as a guide to general conditions, the figures of July's iron production show a fall of some 20 per cent in the daily output of pig iron as compared with the daily output of February, when production was the heaviest of the year. Reports of cuts in steel prices were used with some effect in the last two days of the week, and some heavy selling of United States Steel followed statements of a reduction of $1.50 per ton in the price of steel rails. The volume of bank clearings throughout the country, however, does not forecast any drastic trade reaction. The money market showed further imports of gold and additional engagements of the metal in London, bringing the movements thus far not much short of $1,500,000. Currency from the interior still finds its way into the Eastern money market, despite an almost negligible demand. Quotations August 8 were call 1½@1¾ per cent; 90 days 4½ per cent. The quotations in the table are those at the close of August 8.

NEW YORK.

	Aug. 1.	Aug. 8.	Shares sold.		Aug. 1.	Aug. 8.	Shares sold.
All.-Ch.	8	8½	900	Int.-Met., pfd.	42¾	46⅞	10,200
All. Ch., pfd.	28	28	200	Mackay Cos.	82¼*	84	100
Amal. Cop.	60⅝	64¾	118,960	Mackay C.,pf.	72¼*	71	100
Am. D. T.	20½*	15	———	Man. Elev.	128*	127	———
Am. Loc.	33	36	4,100	Met. St. Ry.	15*	———	———
Am. Loc.,pfd.	105	103	800	N.Y.&N.J.Tel.	139¼*	———	———
Am. Tel. & C.	71½*	71	———	Steel, com.	66⅛	68⅛	458,450
Am. T. & T.	130	132	8,800	Steel, pfd.	113½	114¾	6,050
B. R. T.	73½	75	17,675	W. U. T.	60	64¾	2,900
Gen. Elec.	138*	141⅛	1,100	West'h., com.	54½	59	3,000
Int.-Met.	15⅝	17	12,300	West'h., pfd.	115*	105	———

PHILADELPHIA.

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
Am. Rys.	42*	42½	Phila. Elec.	14⅝	14⅝
Elec. Co. of A.	11¼*	11⅜	Phila. R. T.	18	19⅛
Elec. St. B'ty	47½	47¾	Phila. Trac.	83	82½
E. E. B'ty, pfd.	30*	———	Union Trac.	43	44

CHICAGO.

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
Chi. City Ry.	180	———	Chi. Tel. Co.	117	115
Chi. Rs., Ser. 1.	70*	60	Met. El. Co.	20*	15
Chi. Rs., Ser. 2.	15*	15	Met. El., pfd.	60*	60
Com. Edison	111	111	Nat'l Carbon	115	115½
Chi. Subways	2⅞	2⅝	Nat'l Car., pfd.	118¼	115½

BOSTON

	Aug. 1.	Aug. 8.		Aug. 1.	Aug. 8.
Am. T. & T.	130⅛	132¼	Mex. Tel.	5¼*	5¼
Cum. Tel.	140	139⅛	Mex., Tel., pfd.	6*	———
Edison E., Ill.	253	255	N. E. Tel.	130½	130½
Gen. Elec.	140	142⅜	W. T. & T.	15½	15
Mass. E. Ry.	14¾	15½	W. T. & T., pfd.	86*	85
Mass. E. Ry., pfd.	79*	81			

*Last price quoted
Shares sold for four days, Aug. 1 to Aug. 6.

Financial Notes.

Sierra Pacific Electric Company.—Stone & Webster, Boston, are offering $1,100,000 6 per cent cumulative preferred stock and $550,000 common stock in blocks of 10 and 5 shares respectively of the Sierra Pacific Electric Company of Nevada and California. The company owns all the stock of the companies doing the entire lighting and power business in the cities and towns of Reno, Sparks, Virginia City, Carson City and Silver City, Nevada. The local companies at present own and operate four hydroelectric stations on the Truckee River with a combined capacity of 7300 hp; 135 miles of high-tension lines and complete distribution systems in the territory served. The companies controlled include the Reno Power, Light & Water Company, the Washoe County Power & Development Company, the Hunter Creek Water Company, and the Sparks Water Company, all of which passed under the control of the Union Light & Water Company, and the Truckee River General Electric Company and its subsidiary, the Carson Electric Light Company.

Balsas Power & Irrigation Company.—A company by this name has been incorporated under the laws of Delaware for the purpose of erecting a hydroelectric plant on the Balsas River, Balsas, State of Guerrero, Mex. The project is being promoted by A. B. Adams, New York, and is capitalized at $8,000,000 in gold. The concession for the enterprise was obtained from the Mexican government by Francisco Alfaro, of Mexico City, attorney for the company. It is the purpose of the company to erect a 20,000-hp station initially, which will subsequently be enlarged to 75,000 hp. The head available is 150 ft. Electrical energy will be used in the mines in the vicinify and will also be employed to a very large extent for operating motor-driven irrigation pumps. The office of the company is at Dover, Del., but the permanent organization of the company has not yet been effected.

Gas Securities Company.—The Gas Securities Company, of New York, has issued a statement of its condition as of June 30, 1910, which shows a surplus available for dividends on the common stock of $1,509,003. This company was organized by H. L. Doherty & Company some years ago as a holding concern for certain investments which that firm and its allied interests possessed. According to the balance sheet, the company now owns $1,915,554 of stock in operating companies; $55,795 in bonds, and has on hand $57,580 in cash. The pool holdings and accrued profits on June 30, 1910, amounted to $256,882. Cash dividends have been paid to the stockholders in this company on both the preferred and common stock at ½ per cent per month. The surplus will probably be distributed in the shape of a stock dividend.

West Penn Traction Companny.—A special meeting of the stockholders of the West Penn Traction Company has been called for Sept. 1 for the purpose of voting on an increase in the indebtedness of the company to $25,000,000. If such an increase is authorized, a general mortgage will be made and bonds issued. Action will also probably be taken at this meeting upon the proposed agreement between the West Penn Traction Company and the West Penn Railways Company. The stockholders of the latter company will also meet Sept. 1 to vote on a proposed bond issue of $6,000,000.

Hammond, Chicago Heights & Southern Traction Company.—A mortgage has been filed with the Western Trust & Savings Bank Company, of Chicago, by the Hammond, Chicago Heights & Southern Traction Company for $650,000 to secure a 30-year issue of 5 per cent bonds of like amount. This company was recently incorporated with $1,000,000 capital, and proposed to build an electric railway from the state line near Hammond, Ind, to Momence, Ill, a distance of 35 miles.

New York, Westchester & Boston.—The Public Service Commission, of the Second District of New York, has been applied to by the New York, Westchester & Boston Railroad Company for authority to issue $5,000,000 50-year, 5 per cent first mortgage bonds. The proceeds of these are to be used for general expenses of right-of-way and construction. They will be especially applied to the construction of the branch line which extends from Mt. Vernon to White Plains.

Mexico Tramways Company.—The annual report of the Mexico Tramways Company (Compania de Tranvias de Mexico, S. A.), which has just been made public, shows that the net revenues for the year, after paying all expenses and fixed charges, were $922,457, which is an increase of $462,808 over the previous year. The sum of $2,066,278 gold was spent during the year in the construction of extensions of the lines of the system and for betterments.

Hydraulic Power Company Bonds.—Spencer Trask & Company of New York are offering $650,000 first and refunding mortgage 5 per cent gold bonds of the Hydraulic Power Company of Niagara Falls, N. Y., due July 1, 1950, and dated July 1, 1910. All of the bonds, which are issued in coupon form, at $1000 each, are redeemable at 110 and accrued interest on any interest date after July 1, 1920, upon six months' prior notice. The Commonwealth Trust Company of Buffalo, N. Y., is trustee and transfer agent. The Hydraulic Power Company was incorporated early this year to acquire the plant, properties, water rights and all other assets of the Niagara Falls Hydraulic Power & Manufacturing Company of Niagara Falls, and the outstanding bond issue of the Cliff Electrical Distributing Company. The outstanding bonded mortgage debt of the company amounting to $2,500,000, including the present $650,000 first and refunding mortgage 5 per cent bonds, is at the rate of approximately $20 per hp of development. The present rated capacity of the power stations of the company is 104,000 hp, which will be increased about Sept. 1 to 124,000 hp. The water is taken from the Niagara River above the falls through a canal about one mile long, which gives a head of 210 ft., the highest at Niagara Falls, between the canal and the gorge. The company owns approximately 1000 acres of land at Niagara Falls, which is rented to various manufacturing concerns on long term leases. These tenants purchase the greater part of the electrical output of the company, which is utilized chiefly for electrolytic purposes.

Forty-second Street Railroad Sale.—The foreclosure sale of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad Company, having been set for Sept. 1, as referred to in the issue of June 30, it now appears that there may be more than one bidder for the property. One cause of the delay in this sale was the determination as to whether the 75 new pay-as-you-enter cars bought by Receiver Whitridge at a cost of $350,365 should be included in the foreclosure. The United States court has now decided that they should be and this fact, taken in connection with the announcement that for some months the line has been earning more than its fixed charges, makes the property more attractive to purchasers. It is said that not only the receiver of the Third Avenue company, but also the receivers of the Metropolitan Street Railway Company will bid for the property. The line runs through a section which is rapidly increasing in population and apparently has great possibilities as a feeder of either the Metropolitan System or the Third Avenue Railroad. The Third Avenue company is the owner of the majority of the $2,500,000 capital stock of the company and the Union Trust Company was the trustee for the bonds.

New York Taxicab Merger.—The Cab & Taxi Company of New York was incorporated last week with an authorized capital of $2,500,000 This new company, it is said, is a merger of the following concerns operating taxicabs in New York. The New York Livery & Auto Company, the Taxi Service Company, the Club Taxi Company, the Union Taxicab Auto Service Company and the Moulton Stable Company. Allan Lexow, of the New York Livery & Auto Company, is the president of the holding company. He said that the merger of the various companies was an absolute necessity under present conditions, and that it had been arranged with the object in view of cutting down operating expenses by concentrating all of the taxis of the various companies in one headquarters. He said that the average mileage per tax in New York City was from 50 to 60 miles, but that only about 35 miles of this mileage are paid for, the lost balance being necessitated by the geographical formation of the city.

New York Electric Lines Company.—Decision was reserved by Justice Bischoff in the Supreme Court, on Aug. 2, on the application of the New York Electric Lines Company for a peremptory writ of mandamus to compel the Empire Subway Company to lease space to it in order to install its electric conductors. The judge gave the counsel for the Empire Subway Company until Sept. 1 to submit a brief on the law points raised by the latter. Mr. A. B. Parker, on behalf of the New York Electric Lines Company, claimed it had a valid franchise granted in 1883, and had therefore the right to string its wires in the ducts of the Empire Subway Company, for which it had tendered $5000, besides offering to give a bond for the space to be leased by it. It was the contention of the Empire Subway Company that this franchise had been revoked by the Board of Aldermen in 1906, that the company never exercised any rights it possessed under the franchise for more than 25 years, that it never had a bona fide office, and that it had its taxes sworn off showing that it was not now a legally established corporation. A full account of the mandamus proceedings was outlined in our issue of July 14.

Federal Light & Traction Company.—The Federal Light & Traction Company has organized as follows: Messrs. James C. Colgate, Harrison Williams, Anson W. Burchard, Samuel McRoberts and Edwin N. Sanderson, executive committee; Mr. W. S. Iliff, president; Mr. Edwin N. Sanderson, vice-president; Mr. Craig Colgate, vice-president; Mr. H. H. Porter, secretary;; Mr. H. N. Wadham, treasurer; Mr. A. Seaton Post, Jr., assistant treasurer; Mr. Richmond Talbot, assistant secretary, and Mr. Charles K. Durbin, general manager. As noted in our issue of June 9, this company has acquired practically all of the stock and bonds of the following properties: Gray's Harbor Railway & Light Company, Aberdeen, Wash.; Sheridan (Wyo.) Electric Light & Power Company; Rawlins (Wyo.) Electric Light & Fuel Company; Montrose (Colo.) Electric Light & Power Company; Hobart (Okla.) Light & Power Company; Albuquerque (N. M.) Electric Power Company; Albuquerque Gas, Electric Light & Power Company; Las Vegas (N. M.) Light & Power Company; Las Vegas Transit Company; Tucson (Ariz.) Gas, Electric Light & Power Company and Tucson Rapid Transit Company.

Third Avenue Reorganization Not Approved.—The Public Service Commission of the First District of New York has given two fundamental objections to the reorganization plans of the bondholders' committee of the Third Avenue Railroad Company. The commission claims (1) that the value of the property does not, in its estimation, justify the proposed capitalization, and (2) the probable earning power of the system would for 1909 barely meet the interest ($631,600) on the 4 per cent refunding bonds, and in 1910 and 1911 would be only 2 per cent or 3 per cent on the income bonds, with no evidence that the stock would receive even a small dividend for many years to come; 5 per cent on the incomes calling for $1,126,800 and 6 per cent on the stock, for $995,400. The reorganization committee is reported to have taken issue with the commission on both the foregoing conclusions.

Coney Island & Brooklyn Railroad Issues Bonds.—The Public Service Commission of the First District, New York, has authorized the Coney Island & Brooklyn Railroad Company to issue $489,539 of 4 per cent consolidated mortgage bonds of 1904, which, if sold at 80, would net $391,631, applicable as follows: Coney Island Avenue improvements, $213,777; property abandoned pursuant to legislative enactment, $79,717; other expenses, $62,051; balance of cost of 10 new cars, $16,000; cost of constructing vestibules for 100 cars, $7242; new approach to Brooklyn Bridge, $13,444.

Meridian Light & Railway Company.—The Meridian Light & Railway Company of Meridian, Miss., has increased its capital stock from $1,400,000, of which $400,000 was preferred stock, to $2,000,000 common stock, all outstanding.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
Year ended June 30, 1910	$3,598,492	$110,151	$3,408,341	.....	.....
Year ended June 30, 1909	3,052,616	74,787	2,977,829	.....	.....
Cumberland Telephone & Telegraph Company:					
June, 1910	561,162	319,407	245,755	$48,221	$197,534
June, 1909	536,985	302,279	234,705	41,540	193,165
Manufacturers' Light & Heat Company:					
Six months ended June 30, 1910	3,090,660	1,429,363	1,661,297	309,915	1,355,283
Six months ended June 30, 1909	2,802,699	942,868	1,859,831	492,541	1,367,290
Mexican Light & Power Company:					
June, 1910	567,560	255,555	312,005	.....	.....
June, 1909	443,074	386,319	56,755	.....	.....
Ontario Power Company:					
Year ended June 30, 1910	704,005	131,477	522,688	429,588	118,873
Year ended June 30, 1909	453,409	244,180	172,888	310,346	*128,020

* Deficit.

General News

Construction News.

ATHENS, ALA.—Preparations are being made for extensive improvements and extensions to the municipal electric light and water plant, bonds for which have been voted. The work will include the installation of a new battery of boilers and other machinery and reconstruction of lines. A new engine and pumps may be installed to replace the ones now in use. C. D. White is superintendent of the municipal light and water plant.

CULLMAN, ALA.—A new 200-kw generator and an 18 x 36 Corliss engine are now being installed in the municipal electric light plant. It is expected to have the plant completed by Sept. 1. B. Keil is superintendent of light and water plant.

MOBILE, ALA.—It is reported that the capital stock of the Mobile Electric Company will be increased from $3,000,000 to $7,000,000. R. J. Graff is secretary of the company.

MONTGOMERY, ALA.—Extensive improvements are to be made to the plant of the Citizens' Light, Heat & Power Company, the control of which was recently purchased by Richard Tillis, of Montgomery, Ala., owner of the Montgomery Traction Company. J. G. White & Company, of New York, N. Y., have been engaged to prepare plans and supervise the work, which will include extensive additions to the power house and extension of the transmissions lines to all sections to the city. Large steam turbines and other equipment will be installed.

OPELIKA, ALA.—Bids will be received until Aug. 31 by the Mayor and Council for furnishing all material and constructing an electric light plant and water-works system. Plans are on file at the office of the city clerk, Opelika, Ala., and at the office of J. B. McCrary & Company, of Atlanta, Ga., Empire Building, Atlanta, Ga.

HELENA, ARK.—The Helena Gas Company is contemplating enlarging its electric plant and also proposes to increase the capacity of its water-gas plant. The company is reported to be considering an issue of $50,000 in bonds.

HOT SPRINGS, ARK.—The Otis Elevator Company, of New York, N. Y., has been awarded the contract for installing an electric elevator for invalids in the hospital at Hot Springs, Ark., for $9,984.

TEXARKANA, ARK.—Plans are being considered by the Texarkana Telephone Company for extensive improvements to its system, which will involve an expenditure of about $10,000, and will include rebuilding the line between Texarkana and Clarksville, Tex. F. G. Cook is superintendent of construction.

ALAMEDA, CAL.—Bids have been submitted to the City of Alameda by the Great Western Power Company and the Pacific Gas & Electric Company for supplying the city with electricity for day service. The Great Western Power Company offers to furnish the municipality with a minimum amount of 175 kw at the rate of 1 cent per kw-hour, and all in excess of that amount at 1½ cents per kw-hour. The Pacific Gas & Electric Company offers to furnish the service at the rate of 1 cent per kw-hour and 3 cents per kw-hour for emergency service.

BERKELEY, CAL.—The Great Western Power Company, which was recently granted a franchise to operate in this city west of Sacramento Street, for the distribution of electricity in large quantities, has applied to the City of Albany for a similar franchise. It is expected that the feed wires erected in Sacramento Street will be extended to Albany.

BOCA, CAL.—Surveys are being made along the Truckee River in the vicinity of Boca with a view of constructing a large power plant, to cost about $750,000. It is proposed to tap the Truckee River above Boca; a long tunnel will be built through the mountain south of the river to carry the water, which will be turned back to the river about a mile below Boca. It is estimated that 10,000 hp will be developed, which will be transmitted to Reno and other cities along the Truckee River, for lamps and motors. E. W. Hopkins, president of the Union Ice Company, is interested in the project.

HEROULT, CAL.—Plans are being considered by the Noble Electric Steel Company for the installation of an additional furnace in its plant. Electricity for operating the plant is furnished by the Northern California Power Company. C. B. Morgan is secretary of the Noble Steel Company and H. H. Noble is president of the Northern California Power Company.

MERCED, CAL.—Preparations are being made by the San Joaquin Light & Power Company to rebuild the entire electric lighting system in Merced. An agreement has been made whereby the San Joaquin Company is to extend its transmission lines throughout the Hartley Colony for the distribution of electricity for lamps and motors in that section.

OROVILLE, CAL.—Notice of application of 2000 cu. in. of water in Coldwater Creek, below Buck's ranch in Plumas County, has been filed by John A. Hall, of Plumas County, and George H. Sparks, of Oroville. It is proposed to develop the water power to generate electricity.

SAN FRANCISCO, CAL.—The contract for the construction of an electric light system at the Presidio, San Francisco, Cal., has been awarded to the Decker Electric Company, of San Francisco, for $46,000.

SOUTH PASADENA, CAL.—The Board of Trustees has entered into a contract with the Pacific Light & Power Company whereby the company is to install a tungsten series street-lighting system, which calls for the installation of 550 lamps of 40 cp to replace the present 16-cp incandescent lamps now in use. The rate for energy is to be 7 cents per kw-hour, with a minimum charge of $200 per month.

FRUITA, COL.—Owing to J. M. G. Beard having failed to complete an electric light plant in Fruita in accordance with the terms granted him, the Council is contemplating granting a franchise to the electric railway company.

MONTROSE, COL.—Plans are being considered by capitalists of Montrose and Delta for the construction of an electric interurban railway between Montrose, Olathe and Delta. Electricity for operating the proposed railway will be supplied from the plant at the falls of Gunnison. Steps have been taken to acquire the right-of-way and it is expected that work on construction will begin by fall. The railway will provide for both freight and passenger traffic.

PUEBLO, COL.—The Pueblo-Rocky Ford Land Company, recently incorporated, is building reservoirs and ditches, which when completed will irrigate about 30,000 acres between Pueblo and Rocky Ford. The company also proposes to construct and operate electric light and power plants, to build and maintain telegraph and telephone lines, tramways and railroads. P. J. Dugan, W. J. Lester and J. E. Shoemaker are interested in the enterprise.

STERLING, COL.—The Great Western Sugar Company is constructing a large alfalfa meal mill covering an area of 125,000 square feet in Sterling, which will be equipped for electric drive throughout. The equipment will include four motors.

NEW BRITAIN, CONN.—The contract for installing electrical underground conduits for the City of New Britain, Conn., has been awarded to the Construction Department of the Safety Insulated & Cable Company, of New York, N. Y.

SOUTH NORWALK, CONN.—Plans are being prepared by the Housatonic Power Company for improvements to its plant to be made this fall, which will include replacing the present single-phase alternators with two-phase machines and the erection of a 12-mile transmission line to Georgetown, Conn., passing through South Wilton, Wilton and Cannon Station. J. K. Punderford, of New Haven, is manager; George H. Caffrey, of South Norwalk, Conn., is superintendent.

WASHINGTON, D. C.—The contract for the installation of a heating and power system for the Catholic University of America, in Washington, D. C., is reported to have been awarded to T. C. Basher Company, of Baltimore. The equipment will include a Skinner automatic, high-speed engine, direct connected to a 275-kw generator and water-tube boilers.

SANFORD, FLA.—We are informed that the Sanford Light & Fuel Company expects to install another 100-kw gas-driven unit in its plant in the near future. W. W. Fry is superintendent.

TALLAHASSEE, FLA.—At an election held recently bonds to the amount of $15,000 were voted, the proceeds to be used for the extensions to electric light plant and water-works system.

ALBANY, GA.—C. W. Rawson and associates, of Albany, Ga., are reported to be interested in a project to establish an electric railway in Albany.

ATLANTA, GA.—The Middle Georgia Interurban Railway Company has been authorized by the State Railroad Commission to issue $100,000 in capital stock and $50,000 in bonds, the proceeds to be used for the construction of its proposed electric railway, which will connect Griffin and Social Circle, a distance of 70 miles.

CAIRO, GA.—Preparations are being made to install one 100-kw generator and a 150-hp. engine in the municipal electric light plant within the next three months, for which bonds to the amount of $6,000 have been voted. W. A. Clifford is superintendent.

DALTON, GA.—Plans are being prepared for the construction of an electric-light plant and water-works system in Dalton. The equipment of the electric plant will include compound-condensing engines direct connected to generators with a rating of about 500 hp. The water-works system will include a pumping plant having a capacity of 4,500,000 gal. daily, including a steam pump, an electric pump, filter tank, etc. The H. S. Jaudon Engineering Company, of Savannah, Ga., has charge of construction of the plant.

EAST POINT, GA.—S. T. Maupin, manager of the municipal electric light plant and water-works system, writes that it is proposed to install a duplicate of the present generating unit in the municipal electric light plant before next winter and establish a day service. Plans are also being considered to supply electricity in College Park and Hopeville and also to light the streets in both towns.

MONTICELLO, GA.—Negotiations have been closed whereby the City of Monticello will purchase electricity from the Central Georgia

Power Company, of Macon, Ga., to operate the municipal electric light system. The contract calls for 300 hp. Improvements will be made to the system, including the installation of an electric pump for water-works and other machinery. C. H. Jordan is city treasurer.

CHESTER, ILL.—The capital stock of the Chester Water & Power Company has been increased from $7,000 to $25,000.

CHICAGO, ILL.—The Eastern Illinois Railway Company, which proposes to construct an electric railway from West Hammond to Harvey, Riverdale and the city limits of Chicago, 15 miles in length, has filed a mortgage to secure a bond issue of $5,000,000, of which the proceeds of $400,000 will be used for construction and equipment and $4,600,000 will be held in reserve for construction and other purposes. The proposed route has not yet been definitely decided upon. T. E. Mitten, president of the Chicago City Railway Company, is president of the new company, and A. L. Drum, 125 Monroe Street, Chicago, Ill., engineer.

JACKSONVILLE, ILL.—Sealed bids will be received by the Commissioners of the Meredosia Lake Drainage and Levee District at the office of C. W. Brown, Jacksonville, Ill., until Aug. 30 for furnishing and installing in the district in the west part of Morgan County one simple condensing, four-valve engine with a rating of 114 hp; one 72-in., horizontal tubular boiler, 18 ft. in length; one single suction, 24-in. volute pump, with a capacity of 15,000 gal. per minute; one surface condenser, with not less than 400 sq. ft. of condensing surface, together with suction and discharge pipe and other necessary auxiliaries. Plans and specifications can be seen at the office of C. W. Brown, engineer, Jacksonville, Ill.

PRINCEVILLE, ILL.—Bids will be received by the President and Board of Trustees of the Village of Princeville, Ill., until Sept. 5, for the purchase of the municipal electric light plant, including dynamos, engine, switchboards, transformers and all accessories, poles, wire, lamps and all other appliances pertaining to the above plant. Bids should be addressed to F. W. Cutler, village clerk.

VANDALIA, ILL.—At an election held recently the citizens voted in favor of the proposition to issue $10,000 in bonds, the proceeds to be used for repairs to the municipal electric light plant and extensions to the water-works system.

FORT WAYNE, IND.—The Fort Wayne Electric Works has erected 25 new Woods magnetite arc lamps, invented by J. J. Woods, on the streets in Fort Wayne with a view of giving them a test. The new lamps have been installed on the regular circuits and are burned under the same conditions as the other street lamps.

LOGANSPORT, IND.—Bids are being received by the City Light Department for a 750-kw steam turbo-generator set, contract for which will soon be awarded. The city is erecting a transmission line two and one-half miles into the country to furnish electrical service to the county infirmary and to farmers along the line. Plans are also being considered for the installation next spring of three 500-hp water-tube boilers, with mechanical stokers, and the construction of a smokestack 6 ft. in diameter and 185 ft. high. A tramway is now being built across Eel River to convey coal to the power house. J. H. Stewart is superintendent of the City Light Department.

MUNCIE, IND.—The American Sheet Steel & Tin Plate Company, it is reported, contemplates remodeling and enlarging the local factory. A large amount of new machinery will be installed and the plant equipped for electric-motor drive.

NEW ALBANY, IND.—It is reported that the property of the New Albany Woolen Mills, located on Vincennes Street, has been purchased by a syndicate of New Albany, Ind., and Louisville, Ky., men for $35,000. It is said that a power plant will be installed in one of the large buildings and space rented to small manufacturers with power service. James A. Duffin, of New Albany, Ind., is at the head of the project.

ROCKVILLE, IND.—The City Council has decided to change the municipal street lighting system from direct to alternating current, which will involve an expenditure of about $2,000. The old arc machine will be discarded.

RUSHVILLE, IND.—Sealed bids will be received by A. T. Mahan, superintendent of the municipal water and light plant, until Aug. 23, 1910, for pumping machinery, tank and tower. A 300-hp. boiler, together with heater and stack will soon be installed in the municipal water and light plant.

SOUTH BEND, IND.—Preparations are being made by the Indiana & Michigan Electric Company to place its wires underground in Washington, Colfax and La Salle avenues, South Bend, which will involve an expenditure of about $75,000.

WARREN, IND.—We are informed that the installation of an additional dynamo in the municipal electric light and water plant is under consideration. W. H. Hickerson is superintendent of water-works.

FAIRFIELD, IA.—Plans are being considered by the City Council for improvements to the municipal electric light plant, including the installation of new equipment. As yet the city has not engaged a consulting engineer. W. L. Loring is city clerk.

GRISWOLD, IA.—It is reported that the Griswold Milling & Light Company is preparing to change its plant from direct to alternating current, at a cost of about $3,500. J. W. Daily is superintendent.

SAC CITY, IA.—The Sac City Electric Company is planning to install a steam-heating system, and the installation of a new street-lighting system, using lamp standards. The company has the contract for furnishing electricity for pumping the city water supply for a period of 10 years, beginning June 1, 1910. The equipment is furnished by the company and consists of one 7 x 8 Dean vertical triplex pump, belt driven from 1 to 15-hp, 4400-volt, 60-cycle, two-phase, Westinghouse motors; one 5 x 8 duplex pump; one 10-hp Triumph, 60-cycle, two-phase, 4400-volt motor, operated from central station. R. W. Richardson is manager.

WEST LIBERTY, IA.—Extensive improvements are being made to the municipal electric light plant, which will include the installation of a 200-hp Corliss engine and new generator. A new smokestack will be built and a deep well pump installed.

BAVARIA, KAN.—The Citizens' Telephone Company is reported to be contemplating the construction of a new exchange building in Bavaria in the near future.

FORT SCOTT, KAN.—The Fort Scott Gas & Electric Company is reported to be contemplating extensive improvements to its system, which will involve an expenditure of about $75,000. The company is now asking for bids for machinery to be installed in its plant.

STAFFORD, KAN.—Plans are reported to be under consideration for the installation of electric light, water-works and sewerage systems in Stafford, to cost about $75,000. G. Mibesell is city clerk.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company, which is building an electric railway between Wichita and Newton, Kan., 30 miles in length, will erect two substations along its railway, which will be equipped with motor-generator sets with a rating of 200 kw each. The Kansas Gas & Electric Company, of Wichita, will furnish energy at 33,000 volts to operate the system. O. A. Boyle is vice-president and general manager of the railway company.

THIBODAUX, LA.—Arrangements are being made for the construction of a new municipal electric light plant. The town has extended its corporate limits and proposes to extend the municipal lighting service and the present plant is inadequate to meet the demands for electrical service. The street arc lighting system was destroyed by the storm last September and since that time the streets have been lighted by incandescent lamps.

BANGOR, MAINE.—The Bangor Railway & Electric Company, it is reported, is extending its transmission lines to Northern Maine Junction to supply electricity for lamps and motors. If satisfactory arrangements can be made, it is said that the company proposes to extend its railway to that place, a distance of three and one-fourth miles.

CANAAN, MAINE.—The question of constructing an electric railway from Canaan to Hinckley, a distance of five miles, is reported to be under consideration. It is stated that there is sufficient water power in Canaan, which could be developed to furnish power to operate the proposed railway.

PRESQUE ISLE, MAINE.—The Maine & New Brunswick Electric Power Company is extending its transmission line from its plant at Aroostook Falls to Aroostook Junction, a distance of four miles, to furnish electricity for the Canadian Railway shops there.

BALTIMORE, MD.—It is reported that negotations have been closed between the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., and the Pennsylvania Water & Power Company for electrical power from the McCall Ferry power plant. The contract, it is said, calls for 12,000 kw.

BALTIMORE, MD.—The report submitted to Mayor Mahool and Superintendent of Lamps and Lighting McCuen by H. Kent McCay, president of the McCay Engineering Company, who was engaged to prepare an estimate and make report of the cost of a municipal lighting plant for the city, shows that a plant capable of furnishing electricity for all the city buildings, within a half-mile radius of the old central police station, can be built and put into operation for $35,000. Mr. McCay recommends that the old central police station, on North Street, be used as a site for the proposed plant. If the city would change the building to suit the needs of the plant, he estimates that the cost would be reduced to $30,000. In case the city decides to install its own plant, the engineer recommends that the present plant in the courthouse be retained for use in emergencies. It is estimated that the cost of electricity for lighting the public building would be but 1½ cents per kw-hour, while the present cost is 3 cents per kw-hour for lighting the city hall and courthouse, and for the other buildings, 6 cents per kw.-hour.

BLOOMINGTON, MD.—It is reported that an electric transmission line is being erected from Piedmont, W. Va., to Bloomington, Md. G. C. Patterson, of Bloomington, is interested in the project.

CAMBRIDGE, MD.—The plant of the Cambridge Light & Power Company was offered for sale July 19 by William H. Medford, receiver, and was withdrawn after being bid up to $16,000 by Emerson C. Harrington, representing the Assets Realization Company, of New York, N. Y. The plant was built early in 1909 under a franchise granted William H. Medford and John H. Burgess, Jr., in 1907. It is said that failure to secure the contract for lighting the town was the cause of the failure of the company. Through error this item appeared under Cambridge, Mass., in the issue of Aug. 4.

WESTMINSTER, MD.—The County Commissioners of Carroll County have granted the Baltimore & Pennsylvania Railway & Power Company, of Annapolis, Md., the right-of-way to construct its proposed railway along the Reistertown and Hanover turnpike. At Reistertown the railway will connect with the Emory Grove line of the United Railways of Baltimore, and will connect with the Hanover and York systems near Melrose. J. Pierce Burns is president of the company.

BEVERLY, MASS.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 8

for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring for the United States post office at Beverly, Mass., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Beverly, Mass., or at the above office. James Knox Taylor is supervising architect.

CONCORD, MASS.—We are informed that contracts have been placed for equipment for the municipal electric light plant, all to be installed within the next two months as follows: One 300-kw, turbo-generator set and La Blanc condenser to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.; the Power Specialty Company for three superheaters to be installed in three horizontal return tubular boilers and the Condit Electric Manufacturing Company for a seven-panel switchboard. The primary voltage will also be changed from 1100 to 2200 volts. A. W. Lee is manager.

FAIRHAVEN, MASS.—The New Bedford Gas & Edison Electric Light Company has been awarded a contract for street lighting for a period of five years, under the terms of which the company is to furnish incandescent street lamps for the first three years at the rate of $14.25 each per year, and $13.25 each for the next two years; this is a reduction of $1.35 per lamp per year for the first three years and $2.35 for the next two years.

NORTH ADAMS, MASS.—Negotiations have been closed between Commissioner of Public Works F. B. Locke and the North Adams Gas Company whereby the city has secured a reduction in the rates of electricity for street lighting and public buildings. The contract is for a period of two years, beginning July 1, 1910, under the terms of which the company agrees to furnish not less than 200 luminous arc lamps at $80 each per year, and 50-watt tungsten lamps at $25 per lamp per year; electricity for lighting the municipal building at 6 cents per kw-hour and 4 cents per kw-hour for motors. Under the old contract the city paid $82.13 each per year for arc lamps and $39.40 for incandescent lamps and 7.2 cents per kw-hour for lighting the interior of the municipal buildings and 5 cents per kw-hour for energy for motors.

WATER VALLEY, MASS.—Plans are being considered by the City Council for extensions to the municipal electric light plant, which will include the rebuilding and extensions to the transmission lines during the summer and fall. T. M. Early is superintendent of light and water plant.

WEBSTER, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 14 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, for the United States post office at Webster, Mass. Plans and specifications for which may be obtained from the custodian of site at Webster, Mass., or at the above office. James Knox Taylor is supervising architect.

ADRIAN, MICH.—The Adrian Telephone Company and the Michigan State Telephone Company are to be consolidated under the name of the Lewanee County Telephone Company. The company is capitalized at $250,000. It is expected that other telephone lines will be absorbed by the new company.

ALLEGAN, MICH.—Improvements are being made to the dam in the Kalamazoo River at Allegan. The sluice boards are being removed and two steel and cement gates installed, which will be operated by a motor. The cost of the work is estimated at about $10,000.

ESCANABA, MICH.—Plans have been completed by T. W. Orbison, of Appleton, Wis., for the construction of a new dam two miles above the city.

GRAND RAPIDS, MICH.—Sealed proposals will be received at the office of the Board of Public Works, Grand Rapids, Mich., until Aug. 25 for furnishing and installing two 300-kw turbo-generator sets, two surface condensers, one turbo-exciter set and one motor-generator exciter for the city of Grand Rapids, Mich., according to plans and specifications on file at the office of the board. Proposals must be made upon blanks that will be furnished upon application to the office of the board. Henry J. Klevorn is president of the board.

HOUGHTON, MICH.—The Houghton County Electric Light Company has secured a contract to furnish electricity for lighting the shaft houses of the Isle Royale mine. The company will erect a transmission line through Hurontown to connect with the mining company's system, work on which will begin at once. The installation will include 24 arc lamps and incandescent lamps. The electric company is now erecting a transmission line from Dollar Bay to the Dupont powder plant at Senter, where a substation will be built.

SANDUSKY, MICH.—At an election held recently the citizens voted in favor of bonding the town for water works, sewers and electric lights.

CROSBY, MINN.—Preparations are being made by H. F. Pearce, of Crosby, Minn., who was recently granted a franchise to operate an electric light plant and water-works system, to commence construction work on the same in the near future. The cost of the plants is estimated at about $30,000.

DULUTH, MINN.—The Minnesota Canal & Power Company has been granted permission by the Department of the Interior to the use of public lands in the Birch Basin drainage system in the Duluth land district for power purposes. The project contemplates the development of about 30,000 hp near Duluth. The water will be stored in large reservoirs near Eli, Minn., and will be used to develop electrical energy. The license issued to the company is revocable.

FAIRMONT, MINN.—The City Council is considering the question of making improvements to the municipal electric light plant and water-works system. It is proposed to call an election in the near future to vote on the proposition to issue $30,000 in bonds, the proceeds to be used for the proposed improvements.

GILBERT, MINN.—The local business men, it is reported, are contemplating the installation of an electric light plant in Gilbert, and a franchise will soon be applied for.

LAKEFIELD, MINN.—It is reported that extensive improvements are contemplated to the municipal electric light plant, including the installation of a gas-producer engine.

MONTEVIDEO, MINN.—The installation of an electric light plant in the Chippewa Roller Mill is reported to be under consideration.

OWATONNA, MINN.—The City Council is reported to have granted a franchise for the installation of an electric light plant in Owatonna.

SOUTH ST. PAUL, MINN.—H. M. Byllesby & Company, of Chicago, Ill., are reported to have purchased the controlling interest of the South St. Paul Electric Light, Heat & Power Company. Extensive improvements and extensions are contemplated to the plant and system of the South St. Paul Electric Light & Power Company, including the installation of an emergency connection with the power plant owned by H. M. Byllesby & Company on the St. Croix River. The South St. Paul company recently secured the contract for street lighting in West St. Paul and is planning to extend its transmission lines from Packington to furnish electrical service in that city. E. W. Erick, of South St. Paul, is manager.

KANSAS CITY, MO.—Preparations are being made by the National Biscuit Company, of New York, N. Y., for the construction of a new seven-story factory building in Kansas City, Mo., which will be equipped for electric-motor drive throughout. An electric power plant will be installed in the basement.

ST. CHARLES, MO.—Application has been made to the City Council by O. J. Martin for a franchise to construct and operate a 5-mile railway over certain streets in St. Charles.

BOZEMAN, MONT.—It is reported that preparations are being made by the Gallatin Valley Electric Railway Company for extending its system to Three Forks.

LAUREL, MONT.—Bids will be received by William L. Quesh, city clerk, until Aug. 16 for the construction of a water-works system, including one steel water tower, 150 ft. in height, with a capacity of 75,000 gal.; 5600 ft. electric transmission line, one pump house, one 6-in. two-stage centrifugal pump, one 100-hp motor, together with all necessary appurtenances; also wooden pipe of different dimensions and hydrants. Plans and specifications may be seen at the office of the town clerk, Laurel, or at the office of Henry Gerharz, Billings, Mont.

BRIDGEPORT, NEB.—The Bridgeport Electric Light & Power Company, recently incorporated, with a capital stock of $50,000, is planning to install an electric plant in Bridgeport, work on which will begin immediately.

OMAHA, NEB.—Plans are being made to equip about 150 miles of the Union Pacific Railroad Company's line between Omaha, Neb., and Ogden, Utah, for dispatching trains by telephone, which will complete the telephone system between Omaha and Ogden.

SUPERIOR, NEB.—The Superior Electric Light Company is reported to be preparing plans to make improvements to its plant and reconstruct its distributing system.

BINGHAMTON, N. Y.—It is expected that the report of Alton D. Adams, consulting engineer, employed by the City Council to make a report on the feasibility of establishing a municipal electric plant, will be ready to be submitted to the Council the last of this month. It is said that the report will favor the construction of a municipal plant.

FILLMORE, N. Y.—The Genesee Valley Power Company is contemplating increasing the output of its power plant and extending its transmission lines to some of the neighboring villages in the near future. New equipment will be installed, including a water wheel and new switchboard. E. E. Peake is treasurer and manager.

GLOVERSVILLE, N. Y.—The Fonda, Johnstown & Gloversville Railroad Company has petitioned the Public Service Commission, Second District, for permission to issue $463,000 in bonds.

GOLAH, N. Y.—Application has been made by the Livingston-Niagara Power Company for permission to erect an electric plant in Golah to supply electricity to cities and towns in Monroe and Livingston counties.

JAMESTOWN, N. Y.—The Jamestown, Chautauqua & Lake Erie Railroad Company has applied to the Public Service Commission, Second District, for permission to equip its railway extending from Westfield to Jamestown, N. Y., for electrical operation. The railway is 37½ miles in length and is operated by the Buffalo & Lake Erie Traction Company.

NEWARK, N. Y.—The New Light, Heat & Power Company has begun work on extensive improvements to its plant and system, which will involve an expenditure of about $25,000.

NEW YORK, N. Y.—The New York, Westchester & Boston Railroad Company has applied to the Public Service Commission, Second District, for permission to issue $5,000,000 in bonds, the proceeds to be used for general expenses, right of way and construction of branch lines extending from Mount Vernon to White Plains.

NEW YORK, N. Y.—The Public Service Commission, First District, has authorized George W. Linch, receiver of the Second Avenue Railroad Company, to equip for electrical operation the railway lines from

Chatham Square to Broadway, running two tracks through Pearl and Worth Streets to Lafayette Street, one block east of Broadway, and one track through to Broadway.

NEW YORK, N. Y.—Bids will be received by J. K. Paulding, acting president of the Board of Trustees of Bellevue and Allied Hospitals, Twenty-sixth Street and First Avenue, New York, N. Y., until Aug. 15 for furnishing and installing electric and gas fixtures in the pathological department and male dormitory of the new Bellevue Hospital. Blank forms may be obtained at the office of the contract clerk, 411 East Twenty-sixth Street, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by George McAneny, borough president, City Hall, New York, N. Y., until Aug. 18, for furnishing and installing new electric elevators in the county court house building, City Hall Park, Borough of Manhattan, New York, N. Y. Blank forms and specifications may be obtained and plans examined at the office of the auditor, office of the Commissioner of Public Works, Room 1807, 13-21 Park Row, New York, N. Y.

NIAGARA FALLS, N. Y.—The City Council has granted the Frontier Electric Railway a franchise to construct and operate an electric railway over certain streets in Niagara Falls. The company has also asked a similar franchise in North Tonawanda.

NORTH TONAWANDA, N. Y.—The Tonawanda Power Company, of North Tonawanda, has been awarded the contract for lighting the streets of the city for a term of three years, at the rate of $55 per arc lamp per year.

ROCHESTER, N. Y.—The Bell Telephone Company is making extensive improvements to its system in Rochester, which will involve an expenditure of about $105,000 during the current year.

ROCHESTER, N. Y.—Preparations are being made by the Rochester Railways & Light Company for the installation of a new storage battery of 2000 hp. capacity in its No. 3 station, to be used for emergency purposes.

SALINA, N. Y.—The Syracuse & South Bay Electric Railway Company has applied to the Town Board for a franchise to construct an electric railway over certain streets in Salina.

RUTHERFORDTON, N. C.—At an election held recently the citizens voted in favor of issuing bonds to the amount of $35,000, the proceeds to be used for the purpose of installing an electric light plant and waterworks system.

CASSELTON, N. D.—It is reported that the Union Light, Heat & Power Company, of Fargo, N. D., is contemplating the installation of an electric light system in Casselton. Electricity for operating the system will be transmitted from Fargo.

FORT TOTTEN, N. D.—Bids will be received at the office of Indian Affairs, Washington, D. C., until Aug. 23 for furnishing and installing a heating and lighting system for the grey nuns departments of the Fort Totten School, North Dakota, in accordance with plans and specifications, which may be seen at the above office, the United States Indian Warehouses, Chicago, Ill., St. Louis, Mo., and Omaha, Neb.; the Builders' and Traders' Exchanges at St. Paul, Minn., Minneapolis, Minn., Omaha, Neb., and at the Fort Totten School, Fort Totten, N. D. C. P. Hauke is second assistant commissioner.

WOLFORD, N. D.—Preparations are being made by the Juniata Farmers' Telephone Company for the erection of a telephone line to Rolette, via Pleasant Lake, Rugby and Nanson, a distance of 31 miles.

ATTICA, OHIO.—The municipal electric light plant is reported to have been partially destroyed by fire recently, causing a loss of about $5,000. The plant is able to continue part of its service.

FOSTORIA, OHIO.—The County Commissioners have granted the Fostoria & Fremont Electric Railway a 25-year franchise to construct a railway across the public highways connecting the Lake Shore Electric Railway and the Ohio Western Railway, 21 miles in length. The railway will eventually extend from Fostoria to Amsden. J. D. McDonel is secretary of the company.

HUDSON, OHIO.—Plans have been prepared by D. M. Hosford, 615 Caxton Building, Cleveland, Ohio, for the proposed municipal electric light plant, the equipment of which will include a 100-kw, three-phase, 2300-volt generator direct connected to producer-gas engine, together with complete producer equipment.

JACKSON, OHIO.—Plans are being prepared for extension to the municipal electric light plant, bids for which will be called for. It is proposed to install two 100-kw alternators, one direct-current arc machine with sufficient output to provide for 150 lamps. W. A. Dallas is clerk of Board of Public Works.

TOLEDO, OHIO.—The Macomber Brothers Company is reported to be contemplating the erection of a power building on West Woodruff Avenue, between Twelfth Street and Woodruff Avenue, in Toledo, for the accommodation of small manufacturers. The building will be 210 ft. x 230 ft., three stories high, containing a power plant; provision will be made to install additional units later.

YOUNGSTOWN, OHIO.—The County Commissioners of Mahoning County have decided to build an electric light and power plant for the new court house and jail. The cost of the plant is estimated at $31,000. Judge Kennedy and William Smith were appointed to consult with the Bruce-McBeth Company in connection with awarding contract for same.

LAWTON, OKLA.—The Pioneer Telephone Company is contemplating the erection of a telephone exchange building to cost about $75,000.

PRYOR CREEK, OKLA.—Plans are being prepared by E. T. Archer, 426 Beals Building, Kansas City, Mo., consulting engineers, for the erection of an electric light and ice plant in Pryor Creek, Okla., to be owned and operated as a private enterprise. The equipment will include one 50-kw and one 100-kw directly-connected alternating-current units, together with a 10-ton ice plant, bids for which will be called for in about 30 days.

WOODWARD, OKLA.—At an election to be held Aug. 17 the proposition to issue $30,000 in bonds, the proceeds to be used for the construction of an electric light plant in Woodward, will be submitted to a vote. J. H. Hopkins is Mayor.

EUGENE, ORE.—The Council has granted the Oregon Electric Railway Company, of Portland, Ore., a franchise for the construction of an extension of its system through Eugene.

FALLS CITY, ORE.—Preparations are being made by W. E. Newson, proprietor of the Falls City electric light and power plant, for the construction of a new power house.

OREGON CITY, ORE.—G. Clarence Fields is reported to be interested in a project to construct an electric railway from Oregon City through the Molalla Valley.

BEAVER FALLS, PA.—It is reported that W. J. Coursin, H. L. Tucker, J. W. Humphrey, R. A. Todd and Fred C. Johnston will soon apply for a charter for a corporation to be known as the Park Gate Street Railway Company.

COLLEGEVILLE, PA.—The City Council is reported to be considering the question of granting a franchise for the installation of an electric light plant.

ERIE, PA.—Application has been made by T. Sherman Clark, Edward G. Germer, Hugh Neely Fleming, Frank M. Wallace and Harry L. Moore to Governor Stuart for a charter for the Erie Light & Power Company. The company proposes to generate gas and electricity for lamps, heat and power purposes.

ETNA, R. D. ALLEGHENY, PA.—At an election held recently the proposition to issue $75,000 in bonds for the construction of a municipal electric light and pumping plant was defeated. It is expected that the borough will soon be annexed to Pittsburgh.

PENNSBURG, PA.—Bids will be received by the Pennsburg Electric Light Commission until Aug. 14 for furnishing and installing a 150-hp boiler equipment for the municipal electric light plant, plans and specifications for which can be seen at the office of H. C. Wickert, secretary.

PITTSBURGH, PA.—The Westinghouse Electric & Manufacturing Company has purchased the controlling interest in the Interworks Railroad, which extends from East Pittsburgh to Trafford City, a distance of 7 miles. It is said that the Westinghouse company proposes to improve the road. When the foundry plant is completed the railway will be equipped with passenger cars for the accommodation of workmen and visitors to the various Westinghouse plants.

FORT GREBLE, R. I.—The contract for installing an underground electric system at Fort Greble, R. I., has been awarded to the Whitehall Electric Company, of Westerly, R. I., for $2,800.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has been granted permission by the Board of Harbor Commissioners to lay a cable from a point above Conimicut Point to a place in Nayatt, a distance of about two miles.

PROVIDENCE, R. I.—It is reported that the Rhode Island Company, which is owned by the New York, New Haven & Hartford Railroad Company, will sell its electric railway in Massachusetts to the Worcester & Blackston Street Railway Company for $42,059, subject to approval by the State Railroad Commission.

CHARLESTON, S. C.—Plans are being prepared by the Charleston Consolidated Railway & Lighting Company for the construction of a new power house in Charleston. Paul Spencer, of Philadelphia, Pa., is consulting engineer, and George H. Waring, vice-president and general manager.

ROCK HILL, S. C.—The Board of Public Works, appointed by the Town Council to investigate the question of building or acquiring an electric light and water plant, has reported that the Rock Hill Water & Electric Company, which owns and operates the local water and light plants, is open to a proposition. The company has suggested that a committee, consisting of three men, one to be appointed by the city, one by the company and the third to be appointed by these two men, place a value on the property and holdings of the company. The Board of Public Works has recommended that the proposition be accepted. A. P. Maloney, of Philadelphia, Pa., is president of the company.

BONESTEEL, S. D.—Application has been made to the Council by E. A. Bullock, president of the Norfolk Electric Light & Power Company, of Norfolk, Neb., for a franchise to install an electric plant to supply electricity for lamps and motors in Bonesteel.

LESTERVILLE, S. D.—The installation of an electric light plant in Lesterville is under consideration by the local business men.

GALATIN, TENN.—We are informed that manager of the municipal electric light plant would like to purchase a good second-hand Corliss engine with a rating of from 150 to 200 hp, and also a 150-kw, three-phase, 60-cycle generator. E. L. Anderson is chairman of light committee.

PULASKI, TENN.—We are informed that plans are being considered for increasing the output of the municipal electric light plant in the near future. H. M. Grigsby is chairman of light committee.

COLORADO, TEX.—Plans have been prepared by the Colorado Salt Company for the construction of a steel and concrete power house, bids for which will be received until Aug. 15. Plans and specifications are on file in the office of the company in Colorado, and in the office of the Southern States Steel Company, Dallas, Tex.

CORPUS CHRISTI, TEX.—The City Council has refused the application of H. H. Reed for a blanket franchise to operate an electric street railway over all streets of the city.

COTULLA, TEX.—Preparations are being made by D. A. Walker for the installation of a hydroelectric plant on his farm, located in the valley of the Nueces River, a few miles south of Cotulla. Electricity generated at the plant will be used in connection with plant growing, and tungsten lamps will be installed.

FLATONIA, TEX.—T. M. Spinks and F. C. Bolton are contemplating the construction of a combined electric plant, water-works system and ice plant in Flatonia. The electric plant will have an output of about 50 kw. For further information address F. C. Bolton, of College Station, Tex.

OWENTON, TEX.—John Smith and associates are reported to be contemplating the construction of a power plant in Owenton to supply electricity to operate the proposed railway.

PALESTINE, TEX.—It is reported that work will soon commence on the construction of the proposed interurban electric railway from Palestine, Corsicana and Dallas, for which a greater part of the right-of-way has been secured. William Nathan, of Dallas, Tex., and J. V. Watkins, of Corsicana, Tex., are interested in the project.

SAN MARCOS, TEX.—Surveys are being made by C. E. Metcalf, of San Marcos, for the proposed electric street railway in this city, work on construction of which will commence soon. It is expected to have the system finished by Jan. 1, 1911.

SAN MARCOS, TEX.—The plant and holdings of the San Marcos Telephone Company has been sold to a company organized by local people. The new owners will take over the property in about 30 days and will make extensive improvements to the system. The officers of the new company are: G. G. Johnson, president; D. C. Johnson, secretary and treasurer, and Merton Swift, general manager.

SPUR, DICKENS COUNTY, TEX.—Work has commenced on the construction of the new electric light plant in Spur. Contracts have already been placed for machinery.

TAYLOR, TEX.—The International & Great Northern Railway Company is planning to erect three cement buildings in Taylor, to cost about $15,000, one of which will be used for a power house.

TEXAS CITY, TEX.—The Texas City Transportation Company, which is installing an electric light system in Texas City, has commenced work on the erection of the distributing system. It is expected to have the system completed and in operation within three months.

PROVO, UTAH.—Application for water rights has been filed by F. W. C. Hathenbruch, of Provo, Utah, asking for 8 cu. ft. per second of the flow of water in Slate Canyon to be used to generate electricity at a plant to be erected in the mouth of the canyon, a short distance from Provo, where it is proposed to develop 325 hp.

ST. GEORGE, UTAH.—J. M. Lauritzen, of St. George, Utah, has filed two applications with the State Engineer, one appropriating 10 cu. ft. per second of the flow of Le Virkin Creek in Washington and Iron counties to be used for the irrigation of 11,250 acres of land; the other for 10 cu. ft. of the flow of Virgin River, for irrigating 5120 acres.

ENOSBURG FALLS, VT.—A company is being formed in Enosburg Falls, to be known as the Domina Manufacturing Company, by Mr. Domina, F. W. Draper and A. A. Aseltine. The company has purchased the water power at Samsonville and mills owned by Mr. Domina and proposes to operate a lumber mill, grist mill and an electric light plant. The company will be capitalized at $25,000.

FAIRMONT, VA.—The Fairmount & Clarksburg Traction Company is reported to be installing additional equipment in its power house in Jayenne. It is said that a new building will soon be erected and four new generators installed.

EDMONDS, WASH.—Application has been made to the City Council by Martin Kramer and G. E. Theusen, of Seattle, Wash., for a 30-year franchise to construct and operate an electric light plant in Edmonds.

ELLENSBURG, WASH.—It is reported that S. P. Whipple, chairman of the electric light committee, has recommended to the City Council to call for bids for a 300-hp boiler for the municipal electric light plant. It is also understood that other improvements to the plant are under consideration, which involve an expenditure of about $25,000.

IONE, WASH.—A franchise has been granted to the Ione Water & Light Company to supply this city with light and water.

LACEY, WASH.—A complete hydroelectric power plant is being installed at St. Martin's College, in Lacey. The work will include a storage dam, power house, turbine and generator. The system is being installed by Fairbanks, Morse & Company, of Seattle, Wash. The plant is for the exclusive use of the college and will cost from $6,000 to $7,000.

RITZVILLE, WASH.—The City Council has granted C. A. Lee a franchise for a term of 50 years to contruct and operate an electric system for the distribution of electricity for lamps and motors along certain highways in this township.

CRANDON, WIS.—It is reported that bids are now being asked for the construction of a municipal electric light plant in Crandon, the cost of which is estimated at $10,000. August H. Meyer is city engineer.

FORT ATKINSON, WIS.—Preparations are being made to install a new street-lighting system on Main Street, consisting of lamp standards, each carrying three multiple tungsten lamps. The lamp standards were built in the shops of the City Water and Light Commission, and arrangements can be made to supply other cities with standards of the same design. H. G. D. Nutting is manager of the water and light plant.

MADISON, WIS.—Preparations are being made by the Chicago & Wisconsin Valley Railway Company, of Madison, for the construction of an electric railway to connect Janesville and Merrill, via Friendship, Easton, Portage, Lodi, Middleton and Madison. The company will apply to the City Council for a franchise to construct an electric railway in Madison. Allen T. Russell, of Chicago, Ill., is manager.

RACINE, WIS.—Plans have been prepared by the Racine Tool & Machine Company for the construction of a new plant, 40 ft. x 100 ft., which will be equipped for electrical operation. The equipment of the power plant will include a gas producer, gas engine, dynamo and motors, etc.

WEST ALLIS, WIS.—The Sternburg Manufacturing Company, it is said, will erect a power house in connection with its new manufacturing plant. It is understood that contracts for equipment of the power plant have already been placed.

CHEYENNE, WYO.—Plans are being considered by the Cheyenne Light, Fuel & Power Company for the installation of a 500-kw, 2300-volt, three-phase, 60-cycle generator, direct connected to a Corliss engine. A. G. Langenbach is manager.

BLYTHE, ONT., CAN.—We are informed that the Blythe electric light plant was taken over by the Molson Bank, of London, Ont., June 1, and is for sale, together with a sawmill.

COBALT, ONT., CAN.—A. Ferland, Charles A. Richardson, W. C. Chambers, A. J. Burdett and W. A. Gordon have been granted permission by the Government to build a railway into Porcupine as a feeder to the Temiskaming & Northern Ontario Railroad. The proposed railway will be about 40 miles in length and will be operated by electricity. Power will be obtained from High Falls on the Mattagami River, for which surveys are now being made.

LANARK, ONT., CAN.—It is reported that T. B. Caldwell, of Lanark, has purchased the water power at Playfair, Ont., which he proposes to develop and transmit to Lanark to operate his factory. It is estimated that 500 hp can be developed.

ST. CATHERINES, ONT., CAN.—The ratepayers on July 29 voted in favor of the by-law granting the Ontario Power Company, of Niagara Falls, Ont., a franchise to furnish electricity in St. Catherines.

STRATFORD, ONT., CAN.—At an election held July 29 the by-law to acquire the local electric light plant was carried. The ratepayers also voted in favor of the by-law granting a franchise for the construction and operation of a local street railway service.

CHARLOTTETOWN, P. E. I., CAN.—Sealed tenders will be received at the office of W. W. Clarke, city clerk, Charlottetown, until Sept. 10 for supplying electricity for lighting the streets of Charlottetown and for commercial purposes. Bidders are to state price and illuminating capacity per lamp for street lamps and rate per kw-hour for commercial lighting. For further information apply to the city clerk.

BALSES, GUERRERO, MEX.—The Balses Power & Irrigating Company, recently organized with a capital stock of $200,000, proposes to erect a hydroelectric power plant on the Balsas River in this State. The concession for the enterprise was obtained from the Mexican Government by Francisco Alfaro, of Mexico City, attorney for the company. The company proposes to furnish electricity for mines and other industries, covering a large territory, and will also irrigate a large tract of land in connection with its electrical project. A. B. Adams & Company, of New York, N. Y., are said to be interested in the enterprise.

TETELA, HIDALGO, MEX.—Application has been made to the State Government by Dr. M. D. Shaw, of Puebla, for a concession to install a large hydroelectric power plant on the Rio de Tonalapa, near Tetela. A company will be organized to promote the enterprise.

New Industrial Companies.

THE AMERICAN AUTOMATIC BOILER FEEDER COMPANY, of Waterville, Maine, has been incorporated by George W. Boynton, president; Matthew S. Goodrich, treasurer, and James H. Murray, of Waterville, Maine. The company is capitalized at $100,000 and proposes to deal in automatic boiler feeders.

THE AMERICAN ELECTRIC & MANUFACTURING COMPANY, of Hallowell, Maine, has been organized with a capital stock of $50,000 to deal in electrical appliances. The incorporators are: G. W. Boynton, president; A. Armstrong, C. E. B. Walker, of Waterville; W. W. Wyer, of Fairfield; C. H. O'Brien and Fred E. Beane, of Hallowell, Maine.

THE C. & W. ELECTRIC COMPANY, of Huntington, W. Va., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical supplies. The incorporators are: E. P. Connell, C. L. Waller, W. O. Reckard and others.

Personal.

MR. H. G. LOWELL has resigned as superintendent of the Gardner (Miss.) Electric Light Company to accept a similar position in Colorado.

MR. E. V. EARDLEY, formerly with the General Electric Company, has been appointed electrical engineer of the Knight Power Company, Salt Lake City, Utah.

DR. HOWARD L. BRONSON has resigned as assistant professor of physics at McGill University, Toronto, to become professor of physics at Dalhousie University, Halifax.

DR. JOHN TROWBRIDGE, Rumford professor of applied science at Harvard University, has tendered his resignation, to take effect on Sept. 1. Prof. Trowbridge is 67 years old.

MR. WILLIAM M. EGLINGTON, formerly chief constructing engineer and manager of the Compania Electricia de Concepcion, Chili, has joined the firm of A. Lincoln Eglington & Co., New York.

MR. CYRIL M. SHAW, city electrical engineer of Worcester, England, is in this country, visiting the low-head hydroelectric installation. The plant at Worcester operates at a head of 10 ft.

MR. J. HERMANN has resigned as electrician with the Potosina Electric Company, San Luis Potosi, Mex., to become operating engineer for the Cia Hidroelectrica E Irrigadora del Chapala, S. A.

MR. H. A. FOSTER, consulting electrical engineer, has opened an office at 521 San Fernando Building, Los Angeles, Cal., and will no longer maintain offices in Detroit, Mich., and Pittsburgh, Pa.

MR. J. F. ADAMS, formerly manager at Reno, Nev., for the Pacific Telephone & Telegraph Company, has been appointed general manager of the Nevada-California-Oregon Telephone & Telegraph Company.

MR. HARRY BINDEMANN, formerly of the Siemens-Schuckert Werke, Berlin, has been placed in charge of the engineering equipment of the Electra, a company organized to distribute energy in Madrid, Spain.

MR. ANDREW CARNEGIE.—The Pan-American Congress, in session at Buenos Ayres, on Aug. 4, passed a resolution praising Mr. Andrew Carnegie as a benefactor, and voting him a medal for his services to the cause of humanity.

MR. GEO. WESTINGHOUSE.—Mr. George Westinghouse is the subject of an interesting article in the *New York Times* of Aug. 7. The article is highly complimentary to Mr. Westinghouse as an inventor, organizer and manager.

MR. K. NISHIKAWA, chief electrical engineer for Saiga & Co., Osaka, Japan, has been appointed consulting engineer for the Okayama (Japan) Tramway Company, and chief engineer of the Keisen Electric Railway Company, which is building a line between Kyoto and Otaw, Japan.

PROF. A. M. BUCK, formerly assistant professor of electrical engineering of the New Hampshire College, Durham, N. H., has accepted an appointment to the chair of electrical engineering at the Thomas S. Clarkson Memorial School of Technology. Prof. Buck is a graduate of Cornell University.

MR. A. T. RUTTENCUTTER, who has been with the Rio de Janeiro Tramway Light & Power Company for the past four years, has returned to this country for a visit. Before his departure for Brazil, in December, Mr. Ruttencutter will examine several of the high-tension transmission systems in the United States and Canada.

MR. P. R. OWENS, vice-president of the American Z Electric Lamp Company, left for Europe on the steamship *Oceanic,* on Aug. 10. Mr. Owens, while abroad, will look carefully into the general tungsten lamp situation, and will complete arrangements with the Z lamp interests in Europe for the manufacture of lamps in the United States.

Obituary.

MR. JAMES B. WATT, the oldest telegrapher in point of service of The Associated Press, died at his home in Nashville, Tenn., on Aug. 4, aged 62 years. It is said that he had handled the stories of the assassination of three Presidents—Lincoln, Garfield and McKinley.

MR. STEPHEN ROWE BRADLEY died at his home in Nyack, N. Y. on Aug. 6 in his seventy-fifth year. Mr. Bradley was born in Brattleboro, Vt. and went to Nyack thirty-six years ago. He was a director of the Nyack National Bank, president of the Nyack Hospital, and for years was president of the Rockland Light & Power Company. He is survived by two sons and two daughters.

DR. A. H. GOELET.—Dr. Augustin H. Goelet, of New York, one of the leading authorities in electrotherapeutics in the world, died in New York last week. He was born in Wilmington, N. C., April 1, 1854. Dr. Goelet was a prominent member of the medical profession and held professorships in various medical institutions at various times. He was the author of the Resuscitation Chart issued by the ELECTRICAL WORLD in 1894, and which is still recognized as standard.

MR. WALLACE G. WEBBER, president of the Marlboro Electric Company, the Hudson Electric Company, and the Athol Gas & Electric Company, died suddenly on Aug. 3 at his summer home in Wareham, Mass., after a brief illness, from heart failure. Mr. Webber was for many years actively connected with Boston banking and investment circles, and in more recent times was much interested in Massachusetts public service corporations. He was a native of Bedford, Mass., and in 1888 was elected a member of the governing committee of the Boston Stock Exchange, which was considered a high honor, as he was at that time the youngest man ever elected to that position. For many years he was an active partner in the firm of Paine, Webber & Company, Boston, and later retired to engage in the lumber manufacturing business in his native town. Under Mr. Webber's administration the business policy and technical conduct of affairs in the electric lighting companies at Marlboro and Athol have been placed on a thoroughly modern basis, and he was instrumental in securing the recent consolidation of the Orange and Athol companies, with a view to centralized management and co-operation in service from the established plants. Mr. Webber was a prominent Congregationalist. He is survived by a wife and four children.

Trade Publications.

THE REVOLVING FIELD GENERATORS made by the Lincoln Electric Company, Cleveland, Ohio, are described in a bulletin recently issued by that company.

ELECTRICAL SUPPLIES.—Hibbard, Spencer, Bartlett & Company, Chicago, have issued Catalog No. 111 containing a list of standard electrical supplies, appliances and tools for electric light and telephone use.

SWITCHBOARD TYPE WATT-HOUR METERS.—The Columbia Meter Company, Indianapolis, Ind., has issued Bulletin No. 5, devoted to its astatic shunted switchboard type of watt-hour meter. The armature of this meter consists of six small coils placed parallel and equidistant around the shaft with a separate magnetic core for each coil; each core extending radially outward from both ends of the coils. A six-part silver commutator is employed in connection with the coils, and the armature being somewhat heavier than that of meters of the house type, is equipped with diamond bearings. The meter is not affected by stray fields.

TUNGSTEN LAMPS.—Bulletin No. 4753 of the General Electric Company describes 400-watt and 500-watt tungsten lamps for standard lighting service. These lamps are suitable for large stores, armories, factories, etc., and are economical substitutes for other building units of high candle-power and clusters of small lamps of low candle-power. They have the simplicity, reliability and convenience of the ordinary incandescent lamp of low candle-power. The bulletin contains data regarding cost of lamps and service at various voltages, and illustrates also the fixtures suitable for use in connection with these lamps.

BUSINESS NOTES.

I. P. FRINK, the fixture and reflector manufacturer, will move from 551 Pearl Street to 239 Tenth Avenue, at the northwest corner of Twenty-fourth Street, New York, on Sept. 1.

PITTSBURGH MOTOR VEHICLE COMPANY.—The Pittsburgh Motor Vehicle Company's factory is now located at St. Mary's and Concord streets, Borough of the Bronx, New York City.

THE ELECTRIC DAYLIGHT COMPANY, 74 Cortlandt Street, New York, has purchased the entire business of the Star Electrical Concern, and is preparing to put all types of star flaming arc lamps on the market.

MR. ARTHUR L. MULLERGREN has opened an office as consulting electrical engineer at Poteau, Oklahoma. He is desirous of obtaining from manufacturers catalogs and price-lists of engines, boilers, generators and power-plant apparatus.

THE GARWOOD ELECTRIC COMPANY reports having taken a number of orders recently, among others one for two 100-kw and one 75-kw engine-type generators for the Germania Life Insurance Building, New York City, and a number of slow speed motors for ventilating work in various buildings.

THE WISCONSIN ENGINE COMPANY, Corliss, Wis., has just erected one of the high-speed Corliss engines in the new factory of the Weinbrenner Shoe Company, Milwaukee, Wis. The engine will drive a 200-kw generator at 150 r.p.m. The flywheel is only 11 ft. in diameter and the whole unit occupies very little space for one of its rating.

THE FAIRMOUNT ELECTRIC & MANUFACTURING COMPANY, of Philadelphia, Pa., is now represented in New York State, excepting New York City, by G. E. Bennett & Company, 237 Vermont Street, Buffalo, N. Y. The company manufactures electrical specialties, comprising station pot-heads, ground-clamps, conduit fittings, fixture hangers and test connectors.

DOSSERT & COMPANY, of New York, have opened a western office at 617 West Jackson Boulevard, Chicago, with Mr. George W. Armstrong, as western manager for the territory included in the States of Minnesota, Wisconsin, Iowa, Indiana, Illinois, Missouri and Michigan. A large stock of standard sizes of solderless connectors will be maintained at the Chicago branch to take care of the company's increasing business in the Middle West.

MR. WILLIAM J. A. BAILEY, who recently returned from a trip around the world representing a number of American manufacturers, is now preparing for another business tour. He expects to leave this country early in the fall and will be gone about a year, visiting the leading commercial centers of the world. Mr. Bailey markets his lines in conjunction with permanent sales offices in the different countries, so that this trip would no doubt be of interest to manufacturers seeking foreign trade. His address is 32 Broadway, New York City.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 5, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

965,876. TELEPHONE SYSTEM; O. C. Dennis, Chicago, Ill. App. filed Oct. 29, 1904. Controls the line signal and the cut-out switch for eliminating the line signal when the exchange operator responds to a call by means of a combined relay, including a line signal switch, a cut-out switch and a pair of inductively opposed helices for operating the switches.

965,877. RELAY; O. C. Dennis, Chicago, Ill. App. filed Dec. 11, 1905. Relay for alternately operating a number of switches consisting of a solenoid with a pair of helices for operating a pair of contacts.

965,884. APPARATUS FOR STRENGTHENING ELECTRIC VIBRATIONS; S. Eisenstein, Kief, Russia. App. filed March 27, 1908. For producing vibrations by a Duddell singing arc by means of a variable resistance in series with the arc, which automatically increases as the current decreases and an auxiliary vibratory circuit shunted around the resistance and the arc so as to reinforce the vibrations.

965,891. COIN FREED PREPAYMENT MECHANISM; W. Hamilton, Hollinwood, England. App. filed June 21, 1909. For gas and electricity meters by means of a train of gearing which coact with the holding means for reducing the force required to hold the controlling means in the operative position.

965,900. ELECTRODE FOR VAPOR LAMPS; P. C. Hewitt, New York, N. Y. App. filed April 16, 1904. Consists of an amalgam of lead, tin and mercury.

965,925. ROTOR OF DYNAMO-ELECTRIC MACHINES; R. S. McLeod, Didsbury, near Manchester, England. App. filed June 15, 1909. End rings for short circuiting the conductors of rotors, each ring having a plurality of lugs twisted at right angles to the plane of the ring.

965,973. TELEPHONE TRUNK CIRCUIT; C. S. Winston, Chicago, Ill. App. filed Dec. 22, 1904. Signaling devices and apparatus for trunk circuits for making connections between magneto exchanges and common battery exchanges.

965,976. TELEPHONE EXCHANGE SYSTEM; J. L. Wright, Washington, D. C. App. filed April 12, 1906. Semi-automatic system in which the work of interconnecting subscribers is done by machines controlled by the operators by means of number of wheels operating springs connected to push-buttons before the operator.

965,992. ELECTRICAL CONDENSER; W. W. Dean, Elyria, Ohio. App. filed Jan. 28, 1909. Consist of a plurality of strips of paper, one of which is coated on one side with finely divided conducting material which is dissipated by electrical discharges, and a strip of low-resistance metallic foil, the strips being wound together in the form of a roll.

966,001. SUPPORT FOR THIRD RAILS; L. W. Fox, Norvell, Mich. App. filed April 12, 1909. A rail-supporting clamp having a longitudinally slotted body portion with an arm at right angles and a rail-supporting arm with its free end bent to form a shield support.

966,013. TELEPHONE EXCHANGE SYSTEM; C. E. Hague, Rochester, N. Y. App. filed April 24, 1907. Central trunk line system in which the local exchange operator making use of the trunk line controls the application of ringing current to the calls of the subscriber connected with the main exchange.

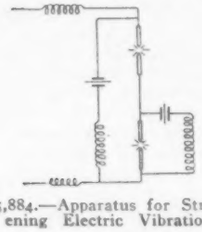
966,025. APPARATUS FOR PURIFICATION OF SEWAGE AND OTHER WATERS; L. G. Lautzenhiser and C. P. Chandler, Los Angeles, Cal. App. filed Aug. 20, 1908. A cast-iron plate electrode with a copper cap or strip secured along one edge.

966,026. COMBINED BOX AND SOCKET FOR ELECTRIC LAMPS; H. W. Lawrence, Denver, Col. App. filed Jan. 17, 1910. An electric lamp socket box which surrounds the lamp socket and has wire entrance aperture with lugs on the box fitting recesses in the socket.

966,033. ELECTRIC ACCUMULATOR; L. Marseille, Paris, and P. Gouin, Lavallois-Perret, France. App. filed July 1, 1909. To prevent the dropping of active material by making the electrode of a cylinder with perforated walls filled with a porous deposit and surrounded by a coil of wire, the nickel deposit cementing the wire to the cylinder.

966,038. CLOCK; F. W. Moore, Austin, Ill. App. filed May 22, 1909. Weight-operated clock reset by an electromagnet at short intervals.

966,086. INSTALLATION OF ELECTRIC CONDUCTORS; E. H. Faile, New York, N. Y. App. filed April 25, 1910. Conduit system with a cap detachably secured to the free end of the conduit, the cap having



965,884.—Apparatus for Strengthening Electric Vibrations.

966,203.—Vapor-Lamp with Concentrated Radiation.

an extension of small cross section and plaster covering the conduit through which the extension projects.

966,097. MANUFACTURE OF SILVERED GLASS MIRRORS; E. Hoorickx, Brussels, Belgium. App. filed June 22, 1909. A frame for immersing mirrors by a swinging action obliquely into a bath, thus immersing the mirrors before the anode enters the bath and avoiding disturbance of the liquid.

966,102. INSULATING SUPPORT FOR OVERHEAD ELECTRIC RAILWAY CONDUCTORS; W. H. Kempton, Hartford, Conn. App. filed July 23, 1909. A section insulator having at its ends means for the attachment of conductor sections with a hanger consisting of two branches so as to support the section insulator against sidewise swing, but permitting the ends to rise and fall together with a messenger cable.

966,139. CIRCUIT-CLOSING PLUG FOR ELECTRICAL CIRCUITS; C. H. Thordarson, Chicago, Ill. App. filed April 9, 1910. A tubular metal body having spring arms engaging the plug and having angularly spaced lugs, the lugs being bent outwardly.

966,203. VAPOR-LAMP WITH CONCENTRATED RADIATION; P. C. Hewitt, New York, N. Y. App. filed March 19, 1903. A vapor lamp with an S-shaped tube, a reflector and hood, so that the radiation starts from a concentrated source.

966,033.—Electric Accumulator.

966,204. INDUCTION LAMP; P. C. Hewitt, New York, N. Y. App. filed July 20, 1904. The lamp is rendered luminous by the influence of a transformer coil which surrounds the lamp bulb.

966,205. APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY; P. C. Hewitt, New York, N. Y. App. filed Oct. 9, 1905. A discharge device consisting of a vacuum receptacle with means for causing two independent currents to flow therein and other means for causing a discharge.

966,207. ELECTRIC SWITCH; H. R. Hirst, New Bedford, Mass. App. filed Feb. 15, 1909. Snap make-and-break, two push-button switch. Details.

966,239. ELECTRIC LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed May 13, 1910. For securing the shell and cap together by means of a telescoping skirt and sharp-edged ring within the skirt.

966,240. ELECTRIC LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed May 27, 1910. For detachably securing shell and cap together, the shell having latching projections and the cap having a flange and ring with holes engaging the projection.

966,243. WIRE CLAMP; H. R. Ritter, Madison, Wis. App. filed Jan. 29, 1909. A clamp with two lugs, a hole in each lug, a second clamp-plate grooved on its inner face and a clamp screw.

966,246. DYNAMO-ELECTRIC MACHINE FOR THE PRODUCTION OF CONTINUOUS AND ALTERNATING CURRENTS; J. Schurch, Bruchsal, Germany. App. filed May 15, 1908. A field magnet having a series of poles of alternate polarity and a base of considerable length, the edges of the poles being inclined and meeting at an apex and two successive portions of the periphery of the poles being offset.

966,247. TELEPHONE RECEIVER; E. Schwartz, Antwerp, Belgium. App. filed April 20, 1907. A continuous integral thin metallic shell with a flared end, a reinforcing ring metal cap and a ring on the cap with insulating material molded over the shell.

966,252. ELECTRIC SWITCH; J. F. Smiley, Louisville, Ky. App. filed April 27, 1910. For electric scoreboards in which the switch includes a plurality of radial arms and adjustable extensions carrying contact shoes.

966,255. TROLLEY; S. H. Smith, Pittsburgh, Pa. App. filed March 14, 1910. The harp has an angular end with parallel arms in a horizontal plane carrying the trolley wheel by means of a rectangular bearing.

966,286. ELECTRIC SWITCH; J. H. Wright, North Fort Worth, Tex. App. filed March 6, 1909. Combination lock switch including a rotatable shaft with fixed and loose arms thereon and controlled by a combination lock system.

966,301. TROLLEY SAFETY LOCK; J. L. Blair, Butler, Pa. App. filed July 2, 1909. To prevent trolley wheels from leaving the wire by means of spring-pressed fender jaws carried by the trolley pole.

966,311. FASTENING DEVICE FOR INSULATORS; W. G. Clark, New York, N. Y. App. filed July 27, 1906. A slotted insulator with filling devices to fit between the wire and the walls of the slot.

966,328. LAMPLIGHTER; C. A. Hacker, Fairhaven, Mass. App. filed Feb. 11, 1909. For lighting a kerosene lamp by means of a sparking circuit, the elements of which are carried in a base below the lamp.

966,355. LAMP SOCKET; C. D. Platt, Bridgeport, Conn. App. filed May 31, 1910. Keyless lamp socket with an interior groove with walls projecting inwardly and a body part fitting the shell and having a lug projecting within the groove.

966,360. CIRCUIT BREAKER; W. E. Richards, Portage, Pa. App. filed March 5, 1910. For trolley lines in coal mines, including a knife switch which automatically opens and closes the circuit between the trolley and a section of the wire.

966,361. RECORDING TARGET; S. A. M. Rose, Richmond, near Melbourne, Victoria, Australia. App. filed Aug. 3, 1908. For company or volley firing and firing of single shots. Combines with a target a copy of the target with electrical means for indicating the permanent marks on the copy the places where bullets strike the target.

966,368. ROTARY SNAP SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 14, 1908. A rotary snap switch with a spindle and rotary blade carrier in two parts, one loosely mounted on the other whereby the blade is self-adjusted.

966,382. ELECTRIC WELDING APPARATUS; A. E. Buchemberg, Toledo, Ohio. App. filed Sept. 25, 1909. A work support with two relatively movable work supporting arms, one of them being reciprocatory and actuated by a spring in one direction.

966,399. PROCESS OF PURIFYING ELECTROMETALLURGICAL PRODUCTS; F. W. Higgins, Niagara Falls, N. Y. App. filed Feb. 28, 1907. For carbide of silicon and the like by digesting the material in an oxidizing bath containing hydrofluoric acid.

966,400. TEST COUPLING FOR ELECTRIC CONDUCTORS; P. J. McDonald, Rochester, N. Y. App. filed June 20, 1908. A coupling for avoiding the destruction of the joint between two sections of a railway conductor when locating a leak. Makes use of a base of insulating material into which the conductor sections lead.